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Table of Contents on Page 2

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Fokker Flies His "Spider"- 1910



By himself, Anthony Fokker built and flew his first airplane, "The Spider", as a young man of 23. Before he took off at a good angle of climb for those days, the plane, with its one man crew, had no reason to stay away from the ground, being inherently stable. In "The Spider" Fokker won several awards from European governments in flying competitions. Later, during World War I, he became one of the world's outstanding airplane builders—and then, at the end of the war, using some of the enormous quantities of aviation in this country, Anthony Fokker came to the United States where his great knowledge and skill made valuable contributions to the advancement of American aviation.



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Domestic

Lockheed Aircraft is setting up a new division to design, develop and produce jet engine aircraft and related facilities at the company's Burbank, Calif., plant. The division will be headed by Lt. Gen. Edward R. Greiner (USAF Ret.), who will resign as vice president of Olin Industries to take over the Lockheed post.

Slick Airways last week announced sale of two DC-6As to Compagnie Maritime des Chateaux Reunis, joint venture of UAF, French carrier (Aeronautique Weekly Oct. 28, p. 106). The status, basic delivery of the first transport Nov. 12, will receive the second not later than Dec. 10. Price of each DC-6A, \$1,050,000 plus approx. roughly \$200,000 in spares.

Douglas DC-7 received its CAA certification Nov. 12, just 22 months after the company agreed to build the transport. Douglas claims the time as a record for development and certification of an airplane.

Strickland North American Airlines last week reported production of one plane each day since United States Workers (UAW) ended wage walkouts Oct. 21 at NAA plants in Los Angeles, Fremont, Calif., and Columbus, Ohio. J. S. Southern, vice president manufacturing, said 65% of NAA's production and maintenance workers were on the job and that more were returning each day.

Ruskin bleeding construction of Sikorsky Aircraft's new 517 four-engine helicopter plant at Stamford, Conn., last week were closed again when a majority of technicians succumbed to this flu-muscle fight against the proposed isolation. Union operation controllers supported the United Aircraft Corp. Division, which employs 4,300 workers at center Stamford and plant to add 3,500 at the Stamford site.

Plant progressive semi-automatic assembly line to be set up by the aircraft industry at producing Wright Turbo Compound engines at Garbo-Wright Corp.'s Wood Ridge, N. J., plant. Roy T. Hazen, president and chairman of Wright Aeronautical Division, says the new line takes 42% less time than the World War II version it replaced, raises engine production capacity by 250%.

Airport facilities in the U. S. soon will be inadequate to meet the needs of growing airline passenger traffic, es-



French Order Vautour Tactical Jets

The French Air Ministry has ordered an undetailed quantity of transport S.O. 4019 French tactical fighter bombers, under the prototype shown above. Production version of the Vautour will be powered by Saurat Atlas HBC dual-flow turbojets rated at more than 6,800 lb static thrust each. The prototype has 5,200 lb thrust turbojets. Plans call take a crew of not in two, depending upon mission.

Financial

United Aircraft Corp., East Hartford, Conn., reports consolidated net income of \$15,537,870 for the first nine months of 1953. Sales sales totaling \$379,637,579. Earnings and government letters of intent. Approximately \$1,190 million.

Pacific Northwest Airlines net earnings for the first nine months of this year totaled \$179,000 from \$4,630,000 in operating revenues.

International

New international airport will be constructed at Bogota, Colombia, as a 1,900-acre site with two 13,000-ft. non-directional runways.

Round air traffic business of \$25,473,000 was handled by International Air Transport Ass.'s closing losses in London during August, posting the peak of \$21,740,000 net last July. IATA reports August total compared with \$26,167,000 for the same month last year.

Vacate Alexander Almonacid, 79, American aviation pioneer, died Nov. 17 in Buenos Aires.

Passenger traffic at Düsseldorf's Loharweg Airport increased 40% during the last three quarters of this year, reflecting a gradual rise in air travel throughout West Germany.

period to increase more than 55% during the next 20 years, Adam Ensey, S. Lead, president of Air Transport Ass., forecast last week.

Douglas Aircraft last week delivered to Japan Air Lines the second of a fleet of DC-6Bs scheduled to reorganize JAL's twice weekly trans-Pacific service between Tokyo and San Francisco next February. A third DC-6B will be ferried to Japan later this month.

Sturdy rank of nearly a billion miles flown without a passenger fatality was completed by Military Air Transport Service during the first 18 months of this year, reports Lt. Gen. Joseph Smith, MATS commander.

First jet stream flight of the season was completed this month by Pan American World Airways, flying 3,570 miles nonstop from Tokyo to Honolulu in 12 hr 35 min—2 hr. 30 min under the record.

Bell Aircraft has sold Model 47C helicopters to France's national police force, the French armed forces and to Air Océan Mer, air charter service operating in French Indo-China.

John A. B. Smith, 72, aviation pioneer and retired vice president of Curtiss-Wright Corp., died this month at Middletown, Mass.



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The Aviation Week

November 23, 1953

Headline News

NACA Takes Over Jet Testing	12
Carl Service Retains CAA Jobs	12
Self Flight Shows on Air Defense	15
AVIA: CAA, NACA, and the Federal Reserve	17
McDonnell-Douglas P-38	21
USAF, General Power, Way for E-12, Jr.	21
Blackburn on CAA Label	18
CAA, Military Reserve Navigation Flight	21
E. L. Kennedy Trust Seen in Air Risk	21
Financing 34th	19
Financial Officer Airborne Jet Design	20
Defense New Contract Program Policy	20
New Plans Need More Timeliness	22
NAL: Northrop Jet Solutes	24

Aeronautical Engineering

NACA Research Crash Data	24
New Helio Design Shows	27

Production

Goody-Buller Hapgood Structures	18
8 and Laminar Flow in Aircraft Testing	41
French Capor Look on Truck	48

Financial

Collyer Typifier Airman Growth	22
Northrop Not Also, Sales Drop	51

Airframes

Vickers Takes Car From Fly	57
----------------------------	----

Equipment

NEC Solves Electrical Problems	47
NVA Tests Wing Bids Comparison	72

Air Transport

Douglas Jet Kites in Jet Refueling	44
------------------------------------	----

Editorial

Grain Test for Corps Lines	58
----------------------------	----

Departments

News Digest	7
Washington Roundup	9
Industry Observer	10
What's Best	19
Travel & Living	20
Personnel Briefing	21
Survey Comments	22
Fiber Control	44
On the Line	73
New Aviation Products	74
News on the Market	75
Stockings	76
Personnel	77
Aviation Calendar	96

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Washington Roundup

Arctic Defense

One of the real issues behind President Eisenhower's recent visit to Canada was to help smooth down defense of the Arctic and the Royal Canadian Air Force on the defense problem.

One major note involved a location of each winging radar stations.

CAB Probe

Under Secretary of Commerce Robert Markey told a Washington audience that he knows of "no investigation that is important" regarding the Civil Aeronautics Board (CAB) report on the crash of the TWA 800. Markey said he does not believe any report change is contemplated in CAB. Markey said the report "could be the result of the latest news of the same Indian Airlines," according to Markey.

Bomber Problems

Future development of the B-52D 321 bomber problems may be affected by the news of Gen. Curtis E. LeMay, head of Strategic Air Command on the future equipment requirements of SAC. LeMay is strongly in favor of the Air Command in favor of a military equipment for a jet bomber for aerial refueling of SAC bombers and long range fighters.

ARDC-AMC Feud

Portuguese aircraft believe the steps of Gen. Gen. Cook in ARDC-AMC feud can with authority over Air Materiel Command and Air Research and Development Command may signal a truce in the latter battle between these two commands.

Portuguese are pleased if and where Gen. Cook leaves his present post.

Off-Shore Buying

Future trend of off-shore procurement of military aircraft is being determined by discussions between Roger K. Kato, Deputy Secretary of Defense, and Harold Stinson, head of the Foreign Operations Administration.

However, differences have developed between the Air Force and Defense Department over what type of plan to buy and how much to pay. Outlook is that the fiscal 1954 aircraft procurement program probably will be delayed until spring.

McCarthy Plans

No aircraft plants are now on the list of defense plants scheduled for investigation of communists by the Senate committee headed by Sen. Joseph McCarthy, but some may be included later. McCarthy's group is interested particularly in management's rights to fire employees with communist affiliations.

Air Mail Experiment

Among issues limited by the Post Office Department last in trial experiment in handling first-class mail by air on the New York, Washington and Chicago routes.

Airline has handled all the mail given there.

Letters presented as late as 8 p. m. make cash room delivery at another city.

Cash can't be estimated accurately. Detailed route studies are required.

Discussion of the problem is postponed. In the first month of the service, with total 726 tons flown, first-class mail is possible on N.Y.-Chicago 385,578, Chicago-N.Y. 623,578, Washington-Chicago 147,130, Chicago-Washington 274,565.

Airline pay for the 51 million letters carried in previous month says space Oct. 6-11 was 994,086.

Post Office's end studies on a proposed Pacific Coast service are still in an early stage. New York-Pittsburgh service is also being considered.

Air Transport Union forecasts that expected first-class letter mail for air will help boost total domestic airmail tonnage from 225,000 tons this year to 1,240,000 tons in 1970.

USAF Staff Problem

Among solutions suggested to ease the terrible work load on the top-level USAF staff is creation of an additional vice-chief of staff placing one in charge of operations and the other in charge of material.

Praise for Airlift

Pacific airlift is credited with handling more than 400,000 casualties during the Korean war with only five deaths. These occurred in an overall collapse in the ground. Dr. Melvin A. Carling, Assistant Deputy Secretary (Health and Medical), also credits the airlift with maintaining an adequate supply of blood in the combat zone.

Westinghouse Jet Move

Congressional and labor union pressure is being exerted on Navy to block a Westinghouse Electric Corp. proposal to move its jet engineering facilities, about one-quarter of its Chicago plant at Lemont, Ill., to the government-owned plant at Kansas City, Mo., where the firm produces jet engines. The company officials expect and has its spare parts facility at Lemont in addition to the jet engineering department. Westinghouse reasons its engineers are 1,500 in Kansas City, the production plant and transfer between the plants by engineers themselves and engineers is too costly. Navy is not likely to decide the issue now since Westinghouse would have to build additional facilities at the Kansas City plant in order to house the engineering department.

Civilian Comptrollers

Senate Armed Services Subcommittee under Sen. Ralph L. Flanders, which has been looking into Defense Department fiscal policies, is likely to recommend civilian assistant secretaries as comptrollers for the three services. The subcommittee's report is due early in December. Big question is whether Air Force Secretary Harold G. Telford will continue to oppose civilian comptrollers, a plan recommended by Defense Secretary Charles Wilson (Aviation Week Nov. 16, p. 17).

—Washington staff

INDUSTRY OBSERVER

► Convair F-107 delta 23-a after acceptance test Mach .98 in a steep climb during early flight tests before it crashed on takeoff (AVIATION WEEK Nov. 9, p. 18). Convair does not plan to salvage the damaged plane and is concentrating work on making completion of the second F-107 prototype now scheduled to fly in early December. Convair pilot Sam Simonsen will fly the second prototype, replacing Dick Johnson who was hurt in the crash.

► Sikorski, Belgian National Aviation, probably will fly from three to six Sikorski HO4Senger 3-45 twin-engine helicopters when they become available for commercial use. Sikorski now is operating the first international passenger service with helicopters and is pleased with the performance of its eight-passenger Sikorski 3-35.

► McDonnell, Hiller and Sikorski are working on versions of a flying crane helicopter similar to the Hughes XH-37. This type of helicopter is aimed at lifting heavy loads, such as tanks and artillery across rivers, over ridges and other terrain obstacles.

► North American Aviation's Navaho long-range missile is nearing the flight test stage at Edwards AFB.

► Although Navy hasn't said so officially, it has virtually abandoned hope for an Alouette T-30 helicopter development using two power sections geared to a single set of propellers. North American's A33 powered by two of the best new T40s was canceled about two ago and service contracts are in the works for the Convair 330 flying boat and the Douglas A2D carrier-based attack bomber, both dependent on the T40 powerplant. Meanwhile, the eight-seat Allison T39 is making a deal with and will be used in the Convair C-119C and the Lockheed C-119 transport.

► General Electric's J75 turbojet producing about 9,200 lb static thrust is scheduled for use in several long-range missiles in addition to aircraft installations not yet announced.

► USAF weapons board recently inspected the making of the Republic delta P-35 fighter-bomber at Republic's Farmingdale plant. P-35 is also planned in an RF-107 reconnaissance version.

► Convair now is working with both General Electric and the Curtis-Wright Corp. on its exploration of nuclear power for aircraft.

► McDonnell Aircraft Corp. P-3H Voodoo long-range fighter will be equipped with a retractable refueling probe for use with the probe-and-drogue aerial refueling system developed by Flight Refueling, Inc.

► Lockheed has developed a flying test bed with a 20-ft. wingspan for flight testing concept developments. The flying test bed is sublaunched from a mother plane.

► Republic F-3HF Thunderstreak is scheduled to get a shif, all-flying test cranked into the production line somewhere between plane No. 250 and 300. Meanwhile, Republic is discussing some of the excess P-3AFs that have come off the production line without R65 Saphire turbojets.

► Navy recently completed career trials of its latest crop of seagoing aircraft including the Douglas F4D, McDonnell F3H Phantom, Grumman PVF-7 Corsair, Grumman S2F anti-sub plane, North American F-4J and the Vought F7U-3. Trials were aboard the carrier Good Sea off Norfolk.

► Royal Aircraft Co., Ltd. is working as Saturn turbojet engine project backed by W. C. Pitts, designer of the lightweight Gnat fighters. The Saturn was originally scheduled for 3,000 lb thrust output for the 6,000-lb Gnat. After British Ministry of Supply refused to support the Saturn project, Pitts found service backing to revive the project in a 4,000-lb thrust engine. Gnat is scheduled to make its first flight within a year powered by a 1,600-lb thrust Armstrong Siddeley Viper turbojet.

WHO'S WHERE

In the Front Office

John P. Ruffie, former president of Ruffie Airline and current chief of Ruffie Ruffie School of Aviation, has been appointed president of National Union Life Insurance Co., Miami.

R. H. Wink will become principal designer of Britain's Engine Research and Development Ltd. 2, according to Air Commodore E. R. Banks, who plans to return to his firm, Associated Lurgi Co., Ltd.

Donna C. Smith, who resigned from Hughes Aircraft Co. to become customer relations director at Lear, Inc., Los Angeles, has been elected a vice president Frank Spawes, also a former Hughes employee, has joined the LearCo Division as quality manager.

Charles L. Reed is now vice president of Ruffie Airline.

James E. Bradburn, a/1000, vice president in charge of Consolidated Engineering Corp.'s Computer Division, Des Moines, Iowa, has been elected president of the company.

R. F. Kinsler is vice president in charge of Aeromarine Division, San Francisco Division, Westbury, N. Y. Other divisions are responsible for H. W. Kinsler, assistant general manager; S. Davis, chief development engineer; W. Berg, production manager; B. Kern, chief accountant; R. J. Gable, purchasing agent.

Wilfred F. Rockwell, Jr., president of Rockwell Manufacturing Co., has been elected a director of Allegheny Atomic Jet & Rocket in new nuclear and research director for Allegheny.

Donald M. Anderson is chairman of Coast Propellers & Manufacturing Co., Los Angeles, now expansion limited where Coast Prop & Chemical Co. merged with Aircraft Metal Forming Co. and Aircraft Engineers Division association. R. E. Monds, president and general manager, Walter W. Smith, vice president and assistant general manager, R. F. Ruffie, vice president manufacturing, R. F. Winkler, vice president sales, S. S. Bellows, sales manager of the North Division, J. M. Clegg, sales manager, Coast Prop & Chemical, W. H. McPherson, general sales manager. Vito N. Fry has resigned as president to continue design as active and general consultant.

Changes

Gen. Stanley J. Chausse (USA, Ret.) has retired as chief of General Services Division for Air Inc., operations of the Aircraft Engineering Development Center at Tulsa, Tulsa, Okla. He was succeeded by Leonard Z. Dukes, former vice manager at Johnson City, Tenn.

Betty Melrose is new secretary and general manager of Associated Electronics, Inc., Raleigh, N. C. John W. Rasmussen, Jr., has become treasurer and production engineer.

Paul J. Pappas has been elected assistant secretary of Westview Aircraft Co. (Continued on page 11)



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AVIATION WEEK



NEEDLE NOSED DOUGLAS X-3 aircraft banks the air above Edwards AFB, Calif., during a flight test by the Air Force.

NACA Takes Over X-3 Testing Program

- USAF ends flight trials of underpowered craft.
- Experts doubt plane will hit Mach 3 design speed.

Air Force last week passed on the Douglas X-3 supersonic research aircraft to the National Advisory Committee for Aeronautics after a year of secondary flight testing at Edwards AFB, Calif.

The X-3 originally was designed to be the fastest of the post USAF Navy-NACA stable of research aircraft. Its ultimate goal was exploration of supersonic speeds up to Mach 3 (about 2,000 mph at extreme altitudes). However, lack of the special models of Westinghouse J46 axial-flow turbojets originally scheduled for the X-3 now makes it doubtful the aircraft will exceed the speeds already reached by NACA test pilots on the Douglas Supercraft (see page 15).

Increased dimensions—After development difficulties with early types of J46 turbojets Westinghouse was forced to increase the diameter of the later J46 models that are now used on the Chance Vought F7U-3 and scheduled for the Convair F2E. The larger diameter J46 engines will not fit the dimensions available in the X-3 so two J46-17 engines will, alterations have been authorized. They produce 4,500 lb. thrust each.

Then the X-3 now has only 9,000 lb. thrust available to push its 27,000 lb. weight, compared to more than 14,000 lb. thrust from the original scheduled two J46 installation with afterburners.



STURDY WINGS, spanning only 22 ft. 6 in. are highlighted in this view of X-3.

NACA plans to continue flight testing the X-3 at Edwards with Scott Crossfield, the pilot who has flown test in the Skunket, at the controls. Because the X-3 requires a rollout run of about 15,000 ft., it can only be

flown off the broad expanse of Rogers Dry Lake bed at Edwards.

► The Best—During the first year of flight testing only Douglas test pilot William Enders has flown the X-3, which he has dubbed "The Scat."

Stiff Fight Brews on Air Defense

Congress will try to untangle divergent views posed by seven studies on early warning vs. offensive forces.

Air Force will face a stiff fight in the next Congress on the crucial problem of continental air defense.

James D. Douglas, Air Force Undersecretary, recently stated the USAF viewpoint.

"As to the question 'should we place reliance on an air defense system or on best protection' my answer is that we should not."

"Serious questions are posed by the fact that we are the largest of the world's air forces. To do so would be to get serious things first and to direct us toward concentrating our attention on the large-scale threat striking power."

The sharply divergent opinions have strong supporters, and the unbalanced group are advocates. The Senate Armed Services Committee has engaged Robert C. Spurgeon, electronics expert and board chairman of Spangco Electronic Co., to evaluate them for proponent and anti (Aviation Week New York, p. 32).

The major defense studies:

- Valley Study. A result after Russia's 1949 atomic bomb explosion, USAF set up an eight-member committee headed by Dr. George Valley, professor of physics at Massachusetts Institute of Technology.

This committee proposed what we then considered a radically new air defense system of radar nets, command-

ment facilities and sophisticated processing computers. It did not, however, make recommendations on defense weapons as consider early warning. It was estimated that surface defense would take eight to 12 sophisticated on-line and that each would cost about \$4 billion.

The Valley program was predicated on increasing the probable destruction of attacking enemy planes from 10% to 35%.

Project Charles. Under auspices of the Air Force, the three services provided an air defense review by about 30 American scientists, several Canadian and British representatives and representatives of U. S. government defense agencies under the chairmanship of Dr. F. W. Looman, head of the physics department of the University of Illinois.

The Charles study group, working from February through July 1951, stated that the Valley study did not provide for adequate early warning of an attack. Project Charles recommended a major effort to develop the weapons of air defense. Criticism was understandable at the Lincoln Laboratory at MIT.

• Project Lincoln. Financed by Army, Navy and Air Force funds, the project was an inter-service research and development of defense hardware. It is headed by Dr. A. C. Hall, MIT professor of physics.

Dr. Hall was a member of this group, whose recommendations coincided with findings of Project East River. This added to the conflict between the military and the early warning system advocates.

Air Force estimated the cost of the early warning system proposed by the military study would be between \$40 and \$50 billion and could not be undertaken without sharply curtailing strategic military power.

• Kelly Committee. As a result of the disagreement, Inner Secretary of Defense Robert Lovett established the Kelly Committee, of outstanding industrial engineers and scientists to make an independent evaluation.

Headed by M. J. Kelly, president of Bell Telephone Company, the group included Arthur Raymond, vice president of Douglas Aircraft Co., in its advisory membership. In a report made last June, the Kelly Committee took a middle-course line between the military, prone to depend on command and surface interception fleets, and early

warning stressed by civil defense proponents. The report emphasized the requirement for powerful offensive capability, but it put down early warning of the approach of hostile aircraft as "a first essential of an effective system of defense and of a real defense capable of reducing a large loss of life."

• Project East River. While Project Charles was under consideration, the Defense Administration set up its own review. It was conducted by Associated Universities, representing nine major colleges in the Northeastern area, and headed by Lyford R. Nichols, Navy Reserve captain and former officer of the Service Research and Development Board.

This group's report, made in December 1951, urged emphasis on air early warning and defense and on command systems, comprising offensive military power as a defense measure. The East River approach can also strong opposition from military leaders, who argued that prolonged warning, even if only, in a little way, could be the diversion of an attacking force and its possible targets not be ascertained. They maintained that warning of an advance enemy force is of little value.

• Zachariasen-Sumner Study Group. During the summer of 1952, while Project East River still was under way, the staff of Lincoln Laboratory led the Valley Study was also in being and early on it concentrated on air defense and defense against weapons up to 1955) and that another body should be given defense against atomic attack.

Scientists who formed the Sumner Study Group were headed by Dr. Kenneth Zachariasen, prominent nuclear scientist, and chief director of Berkeley-90a series in the first three groups and a member of several West Coast study groups. The study group, which was headed by Dr. Kenneth Zachariasen, prominent nuclear scientist, and chief director of Berkeley-90a series in the first three groups and a member of several West Coast study groups. The study group, which was headed by Dr. Kenneth Zachariasen, prominent nuclear scientist, and chief director of Berkeley-90a series in the first three groups and a member of several West Coast study groups.

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warning stressed by civil defense proponents. The report emphasized the requirement for powerful offensive capability, but it put down early warning of the approach of hostile aircraft as "a first essential of an effective system of defense and of a real defense capable of reducing a large loss of life."

Estimate on cost of full implementation of the Kelly recommendations is \$20 to \$25 billion over a period of six years.

• Bell Committee. The new Administration wanted its own study made. So National Security Council early this year set up a committee under the chairmanship of Lt. Gen. Harold H. (USA 66), Air Force representative a Maj. Gen. Fred Smith.

This committee went beyond the scope of the preceding groups that had limited their considerations to attack by aircraft and missiles, including missiles fired from submarines. It considered, for example, the possibility of launching bombs in ships and submarines to strategic targets. This committee did not, however, weigh offensively against defensive power, to the Kelly committee did.

In its recommendations, the Bell group turned toward the military point of view, but the defense program should be based on the military defense. It laid down a defense plan in three categories of priority. Implementation of the three categories is estimated at \$18 to \$26 billion over a seven-year period.

IATA Approves 30% Cut in Freight Rates

North Atlantic air freight tariffs on bulk shipments will be cut 30% for the 12 months starting April 1, International Air Transport Assn. members agreed at its annual state conference in Hanoi.

The rate agreement specifies that container tariffs shall remain in effect to May 31, but that for the 12 months following there shall be a 30% discount on general merchandise shipments of over 200 kg. or about 440 lb.

Present rates are attractive New York-London at \$1.10 per lb., with a 35% discount for air shipments of more than 45 kg. or about 100 lb.

Special Cargo Rates.—The IATA conference also approved a new set of regulations covering international mail of "special packages" such as radioactive material.

The new rules, three years in process of drafting, provide for classification, certification, labeling and packaging of several thousand commodities that require special attention and handling. Commodities affected include water peroxide, chemicals and pharmaceuticals, as well as radioactive materials.

Million-Dollar F-86

(McGraw-Hill World News)

Italian produced North American F-86D's probably will cost U. S. Air Force nearly \$1 million each when they roll off Fiat assembly lines in Turin, USAF officials in Europe insist on exclusive contracts with Avio Aero.

Priority price of the 50-wheeler jet fighter is \$560,000 under its original government contract signed last May. But Air Force sources say the cost will more than double because of steadily increasing expenses for maintenance, increased maintenance from North American Aviation, shipping charges and similar items.

Many USAF officers ask why the U. S. didn't buy the fighter direct from NAA and pay them in Italy as needed.

They fear this will be a logical question for congressional budget-keepers to ask next spring when they examine the Air Force accounts for the new fleet.

Political Contact.—Politics was the deciding factor in giving the F-86D contract to Fiat instead of buying the fighters direct from North America.

Last May, before the advance contract was signed, the Italian producer was on the verge of laying off a large portion of its work force, the only big airline of

defiant aircraft production men in Italy.

Originally, the company was scheduled to build Britain's de Havilland Venom night fighter equipped with DH Ghost counter-jet engines. Fiat completed tooling order; North Atlantic Treaty Organization planners called the Venom out for performance.

Political officers in Rome soon changed about the possible replacement of a look at Fiat on the eve of a nationwide election in Italy. Strong pressure was put on NATO defense planners to find a substitute immediately, and contract was signed for production of 50 F-86D's with General Electric J47 engines at Turin.

Does the down-fleet with early mounting costs, USAF officers in Europe say they need to be a situation that will lose additional money despite any possible return.

Assembly operations at Fiat directly could be expanded to acquire and Britain's two-engine, delivery Glanier jets, and as a substitute. But delivery price of the fighters is estimated at \$600,000.

Any way the problem is ahead, a lot of money is going down the drain, USAF officers say, and Congress will not withdraw until spring politics starts the situation.



Navy Demonstrates P2V-7 Prototype

Both plans followed, this Lockheed P2V-7 Neptune Navy patrol bomber, prototype of the new P2V-7, flies on its two Westinghouse J44 turbojet engines. One powered J44 is shown beneath each wing, just outboard of the plane's Wright Turbo Compound piston engines. The jet pro-

vide extra power to reduce idling on, provide extra speed while taking on target and other tasks. The J44s are taken out by 1955, Navy says, and add 10 knots to the P2V-7's speed. The P2V-7 demonstrator is now at Annapolis NAS, Washington, D. C., last week on the last leg of a nationwide tour.

port to radarspace data, if that be the case, most airborne radars could convert their antennas to common stock at one third the real dollar value.

• **Salaries to Be Reduced.** Salaries of the two chief executives, the co-chairmen, for the fiscal year ended May 31, 1953, were \$13,200 to Carl Sherman and \$6,000 to Edna K. Sherman. With the transfer of the assets from ATC to the airline, the salaries will be increased to \$10,800 and \$12,000 respectively.

Sherman holds 908,179 common stock shares and his wife holds 732,948 shares.

The airline has taken a loss for the last few years, it reports to NRC. On May 16, 1952, the balance sheet reported a \$16,912 loss. On May 31, 1953, the loss was \$5,575. From April 1, 1953, to Aug. 7, the company showed a \$21,570 loss.

• **Increasing Traffic.** At the end of 1949, the last year of operation, the airline had flown 31,056 passengers 77,972,614 mi. This year, as of Oct. 30, OCA has flown 158,798 passengers 56,018,475 mi.

OCA presently operates solely in California, serving San Diego, Los Angeles, Oakland, San Francisco and Oakland. An application has been filed with Civil Aeronautics Board to extend the route to Reno and Las Vegas, Nev.

Fairchild Offers Jet Design to Airlines

First details of a new jet transport design study, planned around a "wing" wing, were awarded to representatives of 12 companies in a bid last week by Walter Tydon, chief engineer of Fairchild En-



New Russian Copter Shown at Air Display

gineer, Republic, shows a new copter shortly resembling the Sikorski HO4, even to the rear coaxial engine. The Russian craft has a four blade main rotor, three-blade tail rotor and low disk wheel landing gear.

port and Amphib Corp's Assault Division.

Two Wright J67 turbojets, rated at an estimated maximum of 13,000 hp thrust, have been selected as the power plants for the plane.

Although Tydon said the wing wing is a blend of the delta and straight plan forms, observers noted a great similarity to the Handley Page Victor's crescent wing.

Other specifications of the study (overall gross weight, 75,000 lb., standard passenger capacity, 46, cruising speed, 570 mph at 46,000 ft., range, 1,500 mi., wingspan, 100 ft.)

Tydon and the turbojet would cost about \$17 million, assuming that at least 100 were produced.

Defense Sets Policy On Contract Financing

Defense Department's program to tighten government contract financing has moved forward with a new direction of general policies and designation of responsibility for implementing them with uniform rules, procedures, and forms (Aeronautics Week Oct. 12, p. 14; Oct. 16, p. 15).

The "order of preference" is established for: (1) private financing, without government guarantee, (2) guaranteed loans, with financing institutions participating in an amount appropriate to the risk involved; (3) program payments; (4) advance payments, it is recognized, however, that there may be "valid" exceptions in specific cases or classes.

• **State of Contracting.** In putting emphasis on private financing, there was a note of caution: "Financing must sup-

port procurement and should be designed to aid, not impede, essential procurement, but should be so structured as to avoid the risk of financing loss to the government to the extent compatible with aiding essential procurement."

The order (No. 7500.1) issued by Defense Secretary Charles Wilson establishes three guidelines:

• **Government financing** "should be provided only if, and to the extent, reasonably required for prompt and efficient performance of government contracts and subcontracts."

• **Advance payments or guaranteed loan financing** may be made available to a supplier in cases where: "(1) the production or service is essential and (2) no alternative source is readily available without prejudice to the national defense."

These do not apply to small business. • **Termination financing** "may be made available, with appropriate protection of the government's interest, either in connection with or independent of performance financing." The impact of termination or it pointed out, should "encourage suppliers to invest their own funds in performance" of contracts.

• **Defense Administration.** Top responsibility for ensuring uniform administration of financing is placed with the Defense Controller, Assistant Secretary W. J. McNiel. He is to be aided by an eight-member "Contract Review Committee" on the application of policy and the development of procedures and forms for financing.

The committee is to be headed by a representative of McNiel, and include a representative of the Assistant Secretary of Defense for Supply and Logistics (Charles Thomas) and two representatives of each of the services, one representing procurement and one representing financing activities.

On budget financing operations are to be the responsibility of each of the services. Under Secretary Thomas Gates and Assistant Secretary for Management E. Lee Wright are to have responsibility for Navy and Air Force financing activities, respectively.

• **Functions Separated.** The procurement and financing functions as each of the services are to be separated. Their close cooperation "should be promoted at all times." If there is disagreement between the financing office and the procurement office as to the extent or the form of financing, the final is to be decided by the secretary of the service, as his representative.

When a government office requests financing through loans or advance payments, it must certify that the case merits the request and that "the government or service is essential" and that "no alternative source is readily available without prejudice to the national defense" and substantiate the certification with supporting data.



Radome construction results in monodome weight savings over conventional structural members, but excellent sound and heat insulating qualities. Among the many aircraft uses are compartment panels, decks, bomb bay doors, and wing trailing edges. It has varied commercial applications: superstructures of seagoing vessels, railroad cars, housing, trailers, office equipment.

HOW TO GIVE A BEE AN INFERIORITY COMPLEX

Two giant honeycomb structure sheets are being fabricated by skilled assemblers at the Goodyear Aircraft Corporation will soon be a common sight—reflexive "dolls" carried by one of the nation's largest airlines—a doll with an area of 61 square feet yet weighing less than 100 pounds!

This amazing low weight to area ratio is the key to the success of Bondolite—the strong and flexible structural material developed by Goodyear Aircraft.

It consists of a lightweight "filler"—such as the aluminum honeycomb core shown here—in which thin, cast resin sheets of aluminum, stainless steel or some other metal are bonded by an adhesive in some cases adhered-impregnated glass fiber cloth is used.

Goodyear Aircraft, a pioneer in producing difficult

double-contoured sandwich structures such as the radar reflector dolls, manufactures complete panels to any specifications desired by the customer—stiffness, sound materials ranging from honeycombs of metal, plastic, paper, cloth, to solid wood cross sections.

Bondolite construction results in monodome weight savings over conventional structural members, but excellent sound and heat insulating qualities. Among the many aircraft uses are compartment panels, decks, bomb bay doors, and wing trailing edges. It has varied commercial applications: superstructures of seagoing vessels, railroad cars, housing, trailers, office equipment.

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New Planes Need More Titanium

Aircraft builders predict they "will be in trouble" if metal output fails to meet future design requirements.

Los Angeles—High-performance supersonic planes now on drawing boards will be as much as 40% titanium, and the aircraft industry "will be in trouble" if it doesn't get the lightweight metal, West Coast aircraft builders warn.

In testimony to the Senate Strategic Metal Subcommittee of the Defense and Interior Affairs Committee, industry officials confirmed a report by Gen. Keith Metzger, chief of Air National Command & Control Resources Division, that U. S. titanium capacity won't be expanded as fast as possible (Aircraft World Oct. 26, p. 14).

Future plans call for up to 40%—and in some cases 60%—titanium in these aircraft, industry leaders say. If titanium is not available, increased weight will weaken design performance, they predict.

• **Solidly Gusher.**—Sas, Georgia Metals moved the titanium investigation into its second phase last after Metallgesellschaft production of the strategic metal would fall short of USAF's 1993 requirement by 1,000 tons.

The international consortium invited industry leaders to testify on present and future use of titanium.

He reports that two companies—Titanium Metals Corp., at Henderson, Nev., and du Pont de Nemours Corp., in New Jersey—are under contract to produce 13 tons of titanium per day but presently are producing only two tons each per day. Both plants were given a \$15 million government subsidy.

"We want to know whether we should gamble introducing additional plants," the senator says.

• **Payroll Savings.**—Donald W. Douglas, president of Douglas Aircraft Co., reports: "In spite of the fact titanium is expensive, we are using it on our commercial planes, DC-7s, and are making it pay...."

"We are now saving from 1 to 3% of the weight of an airplane in titanium, and in 1957 we probably will be saving as much as 30%."

By using 528 lb. of titanium per plane, Douglas saves 200 lb. in weight. "This is a very important thing," the president adds. "We figure every pound saved is worth \$40 in additional payload."

• **Greater Use.**—Thomas Lamplugh, vice president at Consolidated Valve Aircraft Corp., 644 E. Commercial Blvd. by 1958. Corrosion would be anywhere

some 40% of the airplane weight of military planes in titanium "provided it is available and the quality is uniform, easily detectable, and much cheaper."

"We could use three times as much titanium in airplanes today if we knew those were what we knew now about the metal," he says.

Corrosion's projected designs include greater use of titanium, and "we will be in trouble if we don't get it," Lamplugh warns.

• **Commercial Question.**—Robert E. Gross, president of Lockheed Aircraft Corp., testifies: "We are generally enthusiastic about the possibilities of the metal. Investigation shows that it is structurally economically so well as technically."

"Proper application will increase the speed and maneuverability of aircraft because of the strength and heat resistance qualities, titanium has safety characteristics which the commercial field likes."

Lockheed will require approximately 61,000 lb. of titanium in 1954 and about 152,000 lb. in 1955. Projecting military and commercial requirements for several years to come, Gross predicts agency will be "doubled and even tripled," providing price is reduced and quality is improved.

• **Costly Holdings.**—J. L. Atwood, president of North American Aviation, says



Navy Lands a Marlin

addition of the new Marine F3M1 Marlin patrol flying boat in the Navy's armor has required more changes in handling and moving equipment to take care of planes

has company is optimum about the size of titanium in aircraft structures.

Weight savings as high as 40%, and resulting improved performance, can be obtained," he believes.

"One percent titanium in reinforcement in the structure of the F-86, 5% in the F-108, and at a possible 80 to 75% will be going into designs contemplated 30 to 45 years hence...."

"It is important to note that if this metal is designed into an airplane and themselves it becomes necessary at a result of a shortage to substitute steel, copper, and zinc-containing alloys as necessary to eliminate weight and balance problems created by the substitution."

Atwood points out that this fact assumes great importance when planning in terms of large quantities of high-performance aircraft that would be required in a short time in the event of a major mobilization effort.

• **Costly Hoops.**—Glen P. Nichols, president of Northrup Aviation, estimates that in four or five years Northrup will require about 150,000 tons of titanium annually.

"We are not using titanium presently because it has not been designed into the planes, but future designs incorporate 10% titanium and as time goes on it is possible this will be increased to 40%," Nichols says.

L. M. Hitchcock, in charge of structure and engineering procedures at Boeing Aircraft Co., Seattle, says his company has "great hopes for the use of titanium."

He agrees with Gen. Metzger that 500,000 tons of the vital metal might be needed in 1960 should the United States require major mobilization by the aircraft industry.



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ANGLeins are described fully in the I.A.S. Aeronautical Engineering Catalog. We suggest you refer to this publication for complete data.

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NAL, Northrop List Executive Salaries

National Airlines paid \$486,550 to officers and directors during fiscal 1955, and Northrop Aircraft officials received salaries totaling more than \$381,000, according to reports to the Securities and Exchange Commission.

McDonnell Aircraft Corp. has set up annual retirement payments for four top executives that total more than \$67,000.

Companies must file pensions with annual reports, according to SEC law. The reports:

National Airlines

National paid its president, G. T. Baker, a \$50,000 salary, \$40,631 in bonus and profit shares plus \$6,724 in retirement benefits, during the fiscal year ended June 30.

F. C. Reuter, treasurer and director, received a \$17,000 salary plus \$16,852 bonus and \$5,004 for retirement. R. P. Farnham, secretary, \$12,000 salary, \$16,852 bonus and \$1,581 for retirement. E. J. Kautsch, vice president—operations, \$14,000 salary, \$25,469 bonus, and \$3,374 for retirement.

Walter Sternberg, who resigned June 1 as vice president sales to become president of Kaiser Airlines, received a \$18,133 salary and \$25,746 in bonus and profit shares.

All 19 officers and directors received a total of \$166,385 in salaries, \$213,347 in bonuses and \$24,225 in profit shares. National also paid seven \$68,464 common stock shares, aggregating 16.6% of total shares owned. Officers and directors own 154,882 shares, 18.27% of the total.

Estimated annual retirement benefits



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to be paid top officers of the airline, based on present salaries. Baker, \$19,451; Reuter, \$5,770; Farnham, \$18,510; and Kautsch, \$42,772.

Northrop Aircraft

Northrop paid its board chairman, president and general manager, Oliver P. Eshak, \$60,000 during the fiscal year ending July 31.

Of the \$181,038 paid all officers and directors, Roland J. Pagan, vice president, treasurer and director, received \$13,250. John W. Myers, vice president and director, \$35,138. Kenneth P. Brown, vice president, \$13,278.

At the usual retirement age of 65, based on present salaries, Eshak will receive \$5,376; Pagan, \$3,260; Myers, \$13,510; and Brown, \$7,071. All past-off officers and directors will receive a total of \$67,537 in retirement, the firm declares.

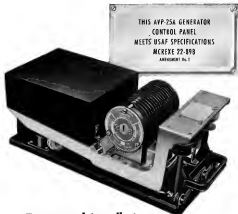
McDonnell Aircraft

McDonnell will pay its president, James S. McDonnell, Jr., \$21,207 annually when he retires at 65.

Based on present salaries, the firm also will pay three senior persons retirement benefits: C. Warren Drake, vice president—manufacturing, \$17,518; Kenneth Perkins, vice president—engineering, \$12,000; and Robert H. Chasler, vice president—contracts, \$10,998.

President McDonnell holds 91,557 common stock shares, 11.43% of the total stock owned, the firm reports. As guardian of his son—James S. III, and John P. McDonnell—he holds 45,705 common shares for each, 6.67% of the total for each holding.

All officers and directors of the company hold a total of 30,546 shares, 4.45% of the total.



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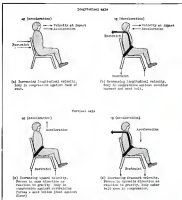
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REACTION

The NACA study says that "the plastic materials sometimes used for window panes shatter rapidly when heated and crack so that passengers will be exposed directly to flames, hot gases and smoke." A cylindrical bulb placed by the window in the forward cabin of one of the transports deliberately crashed by NACA indicated a temperature of 1100° within 100 seconds after the plane caught fire. Three lethal factors in crashes followed by fire are skin burning, respiratory asphyxiation and toxic gases. Therefore, NACA says, "more protection must be provided against all three to improve escape chances [and] significantly."

• Lower fuel volatility extends the escape time when liquid fuel spills, but does not help when a heavy fuel mist layer spreads a plane which is moving rapidly.
• Propeller fragments from prop contacts with the ground are less likely to enter the cockpit if the blades rotate so that they are moving away from the fuselage below the hub and hollow steel blades sometimes bend out of the hub as their rotative after impact when engines are at takeoff power, the report notes. Fuel-aluminum fires generally do not come out of the hub

but break off at the tips, which then become missiles.

Lightplanes

Shoulder harness normally would protect the occupants of a typical two-place tubelined aircraft in stall-type type crashes at impact speeds up to 60 mph. The NACA concluded from its series of full-scale tests on lightplanes. Details on these studies are contained in NACA Technical Note 2591.

Most findings of these tests, in which dummies were used in place of passengers.
• Deceleration force of shoulder harness on the dummy's chest ranged from 32 to 100 when impact speed varied from 40 to 60 mph.
• Without shoulder harness, potential injury is likely, due to head and body striking the instrument panel, as well as the spine in front of the occupant in free of obstacles for a distance approximately equal to the length of the torso from hips to the top of the head, plus seat-belt elongation. This would necessitate a 10-45 lb. rear force of any solid or overloading shoulder brace. As crash speed increases, the

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Lamp Assembly

Vaporproof
Cockle Soap

maneuvering panel is moved farther back by the support.

• Free hand is actually slight in this type aircraft. Civil Aeronautics Board statistics show that less than 4% of high-speed accidents are followed by fire.

• Seat belts used without shoulder harness "should be capable of withstanding higher loading loads than those presently used," NACA technicians note.

THRUST & DRAG

Menager We Don't Want Just a Good. According to a contemporary weekly (not specializing in aviation) one pilot of North American's new F-500 radioed back to earth "If I were ten years older, this plane would be a great substitute for me."

Has any been privileged to know a few war pilots, an aviator would be that I didn't think North American had any pilots that old.

While we're on the subject, east question pertaining to come from test pilots don't say true. "It's a new step," one will be quoted, "and I believe that we really have a world-beater in the Mustang II fighter." Or, incidentally on dropping out of the cockpit, another pilot will expensively say: "Our design team of engineers and production men have come up with another unbeatable combination in the Mustang II fighter. It is performed superbly on the test flight."

But we know what pilots say, don't we? "Who in God's name designed these aircraft?" "Can't you fix that damned heater?" Or, the aviator, accompanied by flying the Mustang II, next to the ground and grinding it into the mud. "Never again, doesn't, never again."

A nice boost for the work at the Air Force Missile Test Center, with special accent on the down-range safety problem, has been given by Army Lt. Col. Turner in his secretarial strip. "Capt. Egan," unsolicited by NEA Service Turner, who has not too far from Patrick AFB, tested the subject with one self-made experiment with accuracy, exploring the elaborate precautions for safety in simple language with pictures. It was in this strip, incidentally, that the Northrop P-60 Black Widow made its first public appearance in World War II. Turner saw dozens of them drag over his place every day, and drew one into a science sequence for Capt. Egan.

Just before a group of us actually took off in a production aircraft, Air War's American Editor Phil Kline gave

AVIATION WEEK, November 20, 1955



Forged-in Quality means Longer Life for Eaton Valve-Seat Inserts

Eaton steel valve-seat inserts are made from hot-upset and pierced blanks. The forging process improves the physical characteristics of the steel, and provides superior wearing qualities in the finished inserts.

The Eaton Saginaw Division is equipped by years of experience, and modern specialized equipment for the high-volume production of seat inserts in all types and sizes—iron and steel, potted or plain—for aircraft, motor cars, trucks, tractors, and Diesel engines.



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Type 440
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Communications System
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150 Channels, 118-136 mc/s
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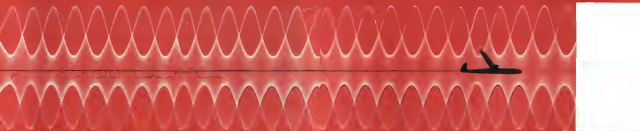


Type 435
Glideslope Receiver
A dual receiver superheterodyne
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GLS signal reception



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aircraft GLS operations
Indicates wind direction at most
critical point of go-around

OUR JOB: KEEP YOU FLYING . . . SAFELY!



Type 390
Transmitter Series
Single channel
750 watts • 111-133 mc/s
Automatic frequency shift
for aeroband control



Type 99 Series
Transceiving Station
200 transmitter 2500 watts, 8-30 mc/s
W 1000 Transmitter 2500 watts, 120-150 mc/s
500 Receiver & 250 Amplifier



Type 430
Package Complete
VHF Station
Receiver Type 205A
Transmitter Type 390A, 50 watts output
Nothing else to buy



Type 982 VOR - Type 982 VOR
Terminal VOR
Omni-Range Unit
One unit answer to improved safety
and reliability of operations under adverse
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Type 99
Multi-Frequency
Transmitter
Facilities for operation
up to four R.T. channels for
operation 115-133 mc/s,
8-30 mc/s, 400 mc/s, and
110-152 mc/s, 250 watts

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the signals from Wilcox equipment will
help you get where you're going and
help you land . . . safely.

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helping scheduled, non-scheduled,
government airlines—here and abroad—fly
safely for more than 21 years.

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This Rhodes Lewis mechanism, appropriately named the "jean stick," simplifies climbing forces to exert stress perpendicularity into the mechanism of high-speed military aircraft. Control is fully electric from remote position. Operation is pneumatic and completely automatic. The stick reposition itself for rebounding after each use. Adaptation of the "jean stick" system are manufactured by Rhodes Lewis in quantity for use on present-day military aircraft.

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SE & NE Air Transportation	0	X	
Interstate Bus & Transportation	X	0	
Local Buses & Transportation	X	X	
Maritime Passenger Services	0	X	
Domestic & Overseas Freight Systems			0
U.S. & Foreign Airlines	0	0	0
Local Airway Freight Service			0
Freight Airline (United/Continental or Western)	X	0	
Freight, International or Domestic Air	0	X	0
General Aviation Services	X	X	

Take advantage of Rhodes Lewis engineering knowledge and manufacturing facilities in the field of electrical and power machine equipment. Your enquiries are cordially invited.



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ENGINEERS • MANUFACTURERS

joined the stewards about a horse-drawn barge that we could hear. It came from under the third row of seats from the tail, and sounded like a hatch banging. She smiled sweetly and said, "That? Oh, that's the turbines."

We smiled too. —DAA

McGraw-Hill World News

Paris—The secret industry is France is losing a great deal of business to the United States, says an association representing the country's top aircraft makers.

In a brochure sharply criticizing the Zionist policies followed by all post-war Israeli governments, the Union Syndicale des Industriels Aeronautiques claims:

• Funds for military aircraft production have been too small, on account of approximately 50%, or \$400 million, is lost.

• **Industry lacks a coherent overall program.** A firm schedule of production should be established not subject to possible changes, reductions or cancellations, says the association. Also, deliveries at U.S. plants under military or program, should be limited to heavy bombers and other types the French industry does not have the financial means to build.

• French airlines, including national and Air France, have been permitted to buy nearly all of those planes abroad. The government could prohibit purchase of foreign planes by refusing to make the necessary foreign exchange available.

• Nothing has been done by the government to help Finnish aircraft builders develop foreign markets. The economic crisis calls for an export program that eliminates customs duties on aircraft and materials used to build aircraft, grants business credits by the government to foreign purchasers of Finnish aircraft and simplifies the regulations governing export.

USIA recommends creation of a permanent committee of the National Assembly to study and deal with sensitive matters.

Distribution of the brochure to government officials and members of the National Assembly followed soon after announcement of the closing of Societe Nationale de Construction Aeronautique du Nord's (Socna) large aircraft factory at Le Havre.

It also coincided with removal of a megasequence among the firms by automated software loaders that would result in shutting down other plants and possibly elimination of *Essex*.



Sound?

With the plane headed home and landmarks all "on-board," the soundness of this casting becomes vitally important. For it is part of an aircraft instrument which must be accurate without fail.

That is why each of these castings is subjected to the searching eye of radiography. It is the way to be sure no hidden flaw, no gas holes or porosity exist.

Proving soundness with v-rags has become common practice with more and more numbers of

quality castings. They have found it helps build an enviable reputation for delivering only good work. And besides, by micrographing pilot castings, changes in procedures are frequently indicated which increase the yield in long runs.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer. Or, if you like, write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

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Kodak
TRADE MARK



Federal supplies the 50-Amp. Transformer-Rectifier unit used in the Stratofortress...
"America's new double-edged weapon"



FOR 3145-B5 AIRBORNE POWER SUPPLY

- AC Input: 115-270 v. ac
- AC Output: 115 v. ac, 50/60 Hz
- DC Output: 28 v. dc
- Weight: 13.5 lbs.
- Dimensions: 10" x 10" x 10"



Federal Telephone and Radio Company

MEMBER-INTELIN DEPARTMENT

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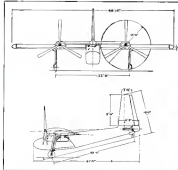
In Canada: Federal Radio and Radio Company, Ltd., Montreal, P. Q.
Export Distribution: International Radio and Radio Corp., 17 West 17th St., N. Y.

Over 100,000 pounds of precision production... 115 feet from wing tip to wing tip... drawing its unique speed and sailing from night powerful jet engines. That's the Boeing B-52... built to serve as a deterrent against aggression... as a weapon of offense, if needed by our strategic air arm.

In the "tradition of rugged dependability" established by Boeing's famous Flying Fortress and Superfortresses, Boeing has designed Federal's 3145-B5 Airborne Power Supply to provide the B-52 with a DC output of 50 amperes, 28 volts.

Federal's 3145-B5 is only one of a complete line of rugged, compact and efficient airborne and ground power supplies developed to meet aviation's growing demand for converted DC to 400-cycle AC... to furnish dependable DC power when required. Federal's equipment is designed without expendable parts that require frequent replacement. And all are powered by Federal Selenium Rectifiers... first in the field... outstanding for long service life and trouble-free performance!

Write for your DC Converter data, write to Dept. E-5110.



TWIN-ENGINE H-6 would fly at 20 mph, at best at 180 mph, Helio says

New Helio Design Lands Slow

A complex, two-engine transport for 20 to 200 mph, flight speed range coupled with short-distance landing and landing in the latest design development of Helio Aircraft Corp., Norwood, Mass.

Design specifications of the configuration were revised only recently, although estimated performance data were submitted to the Air Materiel Command's Engineering Division in mid 1954.

Improved Design—Designated the H-6, the plane design represents an improvement of the current characteristics demonstrated previously in flight in previous aircraft in the Helio plane series.

One of them, the single-engine YL-26 (Aviation Week Staff, p. 7) recently was delivered to the Army for service tests. This plane is basically similar to the four-place Helio Canada certified by Civil Aeronautics Administration.

Lowest Characteristics—Helio's H-6 exhibits basic characteristics of the standard and special-purpose Comm, whose lowest performance is reported to result from a combination of light wings, automatic landing aids and a system of lateral controls reducing instantaneous response at descent speed.

The H-6 Helicopter has the following specifications:

- Design gross weight, 5,000 lb.
- Useful load, 1,945 lb.
- Engines are two 250-hp Lycoming, driving 15 ft diameter propellers.
- Wing area is 600 sq. ft.
- Wing span is 46 ft.
- Takeoff run, 35 ft. This constant rate 120 ft. takeoff distance for the single-engine Comm with a gross of 2,800 lb.
- Takeoff distance over a 50 ft. obstacle is 300 ft. Corresponding figure for the Comm is 500 ft.
- Minimum speed is pegged at under 20 mph. Experience with the H-6 plane control system on the single-engine model indicates that power-on level flight with full gross load at speeds over 20 mph appear attainable, Helio claims.

Helio says that with partial load, the vertical component of propeller thrust exceeds the weight of the airplane. Because a substantial part of the control surfaces lie within the spinner, the company reports a strong possibility still having any be practicable with further development.

- Maximum speed at sea level, 201 mph.
- Cruising speed at 3,500 ft is 158 mph.
- Rate of climb at 5,000 ft, 1,715 ft per min.
- Rate of climb, at sea level with one engine, 770 ft per min.
- Angle of attack, sea level, 29 deg.

• Service ceiling, 27,000 ft.

The H-6 and personal Helicopter aircraft were designed by Prof. Otto C. Kopper, in charge of aeronautical design group at Massachusetts Institute of Technology.

Original specs were conceived by Dr. Lynn L. Ballinger, Harvard Business School professor who now is Helio's board chairman.

In addition to the Courier delivered to the Army, two other Helicopters are being at Norwood—a two-place version with large-diameter propeller and a four-place model with conventional one prop.



Fuel booster pump made by Polysometer

Air Turbine to Drive 3,500-Gph. Pump

A British manufacturer is currently developing a jet turbine air turbine-driven pump with a 3,500-gph. discharge rate.

The company, Polysometer Engineering Co., Ltd., Nine Elm Road, Woking, Surrey, England, under 40 types of aircraft fuel and fuel booster pumps whose capacity range from 11 to 3,000 gph and develop pressures up to 30 psi.

Polysometer's pumps are suitable for use with gasoline, kerosene, methanol and water, nitro, and diesel oil. They will function satisfactorily up to 15,000 ft. on 100 psi fuel. Under favorable conditions the fuel can be handled up to over 20,000 ft.

The manufacturer says its pumps are used by most British aircraft manufacturers including de Havilland, Folland, Gloster, Hawker, Parnall, Westland, and Vickers-Armstrongs, A. V. Roe and Westland.

Argentine Jet Liner

A jetliner jet transport powered by four Rolls-Royce Avon has been designed by Dr. Kar-Tank, former top engineer with Convair's F-106 Wolf Aircraft during World War II, who now resides in Argentina.

Dr. Tank's project has jet transport will be capable of carrying at approximately 600 mph. Placement of the turbojet powerplants in "gate" configuration and mid-aisle, the designer says.

Waffles Stiffen Highspeed Structures

- Grid provides two-way integral stiffening.
- Lockheed reports tests in forging this pattern.

Development of very high-speed aircraft imposes new responsibilities on the structures specialist and the production engineer that conventional design and fabricating methods do not meet. Newer techniques are needed for maximum structural efficiency and top manufacturing economies.

The small built-up assemblies, with skin fastened to internal structure, do not fit adequately in the skins which only meet and meet for thin wings and highly stressed structures. Integrally stiffened structures where the skin and its internal support are one piece provide a solution in this problem.

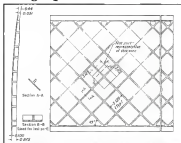
► **New Configuration**—The "waffle" pattern is one of the promising new configurations now under consideration for integral stiffening (Aerospace Week Jan. 5, p. 20). It gets its name from the way the stiffeners run—both longitudinal and transverse—to form a waffle effect.

On this built-up for integral panel structure, Lockheed Aircraft Corp. has done considerable research on its own. It also is conducting additional studies in cooperation with the Air Material Command. And it is getting into the waffle-stiffened test panels which would be suitable directly as aircraft components.

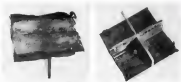
At present, Lockheed production parts have undeveloped integral stiffeners. A more efficient structure could be obtained by incorporating the waffle's additional stiffening elements in the transverse direction, exposing the skin-covering regions of the panel.

When the size of the part does not prohibit the most feasible method for producing this waffle configuration is by press forging.

► **Methods Limitations**—In addition to forging integrally stiffened panels gen-



MAKING OF WAFFLE TYPE integrally stiffened panel is illustrated in the drawing. Lockheed has been forging test panels on 100-ton hydraulic press.



TEST SPECIMEN looks like this, from top and bottom, prior to removal of the forging flash. The top portion measures 3.125 in. (see sketch above).



EXPERIMENTAL FORGING specimens retain no stiffness forming blocks delaminate at right the intensity is heard over and the forming blocks moved out.



NERF shows test panel made of 325 aluminum (top) and 705 aluminum.



fastenings of high temperature metals

In the products you manufacture do you face the problem of extreme heat—800°—1,000°—1,600°—2,000°?

Do you face extreme problems of corrosion or oxidation?

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The Aero Division of Harper specializes in fastenings of such new high temperature metals as Inconel, 321, 346, Hastelloy, Alloys, Incolloy, 19-9-DL, Greek Alcolloy, Titanium, and all Stainless Steels. At Harper, metallurgists and engineers are constantly working with these new metals and developing improved methods of producing fastenings from them—methods to assure better fastenings—stronger fastenings—at lower cost.

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Harper is a division of The H. M. Harper Company, 4000 Dayton Road, Dayton, Ohio 45424. Please send me information on Harper HTA, fastenings of high temperature and corrosion resistant alloys.

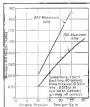
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Company _____
Address _____
City _____ State _____



RESEARCH laboratory's 300-ton hydraulic press work forging dies outlasted



JUNCTION bars extend out from press to prevent restraining power leaks



FORGING PRESSURE vs. Die Height for 73S aluminum and 72S magnesium

easily can be produced by casting, extruding and machining.

However, cast material in such irregularly shaped designs is prohibited by structural requirements.

The tremendous size of some irregularly shaped parts used in current Lockheed aircraft makes it necessary to machine these parts from plate stock on equipment (Addings & Lewis dies mill), specially designed for this type of production (Wheeler Wrenn May 16, p. 46). These self-induced parts are made with well-tempered surfaces at the present time.

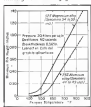
Lockhead also is using extended irregularly shaped structures. Currently available extended self-induced sheet not only is confined in its structure width by the design, at the extension process, but also is limited to the profile of the force configuration.

Small-Scale Work. Now Lockheed material is successfully compressing a self-induced piece in 1952. Purpose of the study was to obtain information on large "pressure" press forgings.

Tests have been run in Lockheed's research laboratories, utilizing a 300-ton hydraulic press to investigate typical settings from a large water-type press. Relationships observed in these small-scale tests are very significant. Lockheed continues to design full-scale parts including proportions that have proven feasible to forge.

It is anticipated that parts desired will require very heavy presses to get close tolerances parallel to the large enough efficiency to replace built-up assemblies. First of the giant forge machines should be operating next year, under the Air Force heavy press program. These new facilities are expected to turn out work with close tolerances and thinner section parts at the same time.

Stresses and Findings. In Lockheed's stress studies, relationship of the following variables to forging character-



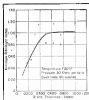
TEMPERATURE vs. R's Height for 73S aluminum and 72S magnesium



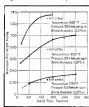
FORGING TOOLING consists of the punch (a) and female form die (b).



LOWER DIE is assembled to permit removal of test part after forging.



BLANK THICKNESS vs. Maximum R's Height for 73S aluminum alloy



DWELL TIME vs. Minimum R's Height for 73S aluminum alloy test part

LEAR VGI SYSTEM

...SIXTH SENSE

FOR THE BOEING B-47

In high-speed maneuvering hazardous errors are introduced by conventional attitude indicating instruments. For greater safety, the jet plane needs something special in the way of an attitude indicator. For the Boeing B-47 and other jet bombers and fighters, this critical function is performed by the Lear Vertical Gyro Indicator System.

Operating as the plane's "sixth sense," the Lear VGI system is designed to measure and display deviation from horizontal flight with unsurpassed accuracy and speed. All necessary gyros, amplifiers, and power supplies are contained in one compact unit which is remotely installed, transmitting pitch and roll intelligence electrically to the flight attitude indicator. The Lear VGI may also be used as a master vertical reference for an autopilot, radar, or other equipment.

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19-2





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On the average airline trip, it takes only slightly more aviation gasoline to carry you to your destination than is needed in \$5 the tank of your automobile . . . about 20 gallons per passenger.



SHELL OIL COMPANY

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100 BUSH STREET, SAN FRANCISCO 4, CALIFORNIA

- Stages have been investigated.
- Faging temperature and pressure.
- Duration of pressure (dwell time).
- Original blank thickness.
- Effect of fuel skin thickness on occurrence of faging defects.
- Stiffness thickness and height.

On the basis of development work completed at Lockheed, the following general conclusions have been made:

- Single-stage press faging is a feasible method for producing waffle-type parts.
- Skin thickness as low as 0.230 in. may be faged at 755 atmosphere. Thicknesses less than 0.210 may be obtained by subsequent skin rolling.
- Nominal faging temperatures for 755 may not exceed 650°.

• Dwell time of from 1 to 5 min. will be required for faging pressures in the range of 10 to 50 atm/in. For higher pressures, shorter dwell times will be required.

• When the rate of stiffness thickness to blank thickness is large, a "backing" type of defect occurs. When the rate is intermediate, a "neck-in" type of defect results caused by vertical shear within the base of the stiffener. When the rate is small, round parts can be faged.

• This blank requires higher pressures than thick blanks, to produce stiffness of similar height and thickness.

• Thin stiffeners require more pressure than thick stiffeners of similar height, from blanks of the same thickness.

• Other Benefits—The research program will advance precision faging processes, because the clear relationship inherent in waffle-type parts will contribute much additional experience in tooling. While faging dies today gradually erode ordinary die-cutting tooling stages, precision press faging will require a higher quality of tooling, composed of segments and inserts.

Two of the key men in Lockheed's program are research engineers Howard B. Wiley, and production design engineer Fred C. Pyles—Living Stone.

Wood Laminate Used In Aircraft Tooling

A high-density wood laminate, widely sold for the finish aircraft industry since the beginning of World War II in such applications as aircraft propeller and helicopter rotor blades, templates, and rubber pens, spinning and sand frame blocks, is now being used widely in the country. At least one major West Coast software manufacturer is using the laminate, called Hy-Glamite. It is also used in the Franklin Machine.

• U. S. Lumber—U. S. Lumber & Shingle Co., Lumber, Mass., has an exclusive American sales agreement with the



More
hours per replacement
with Packard cable



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Packard Cable Works, Boston, Mass. Corporation
Boston, Mass.

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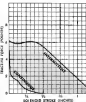
Technique are identified by number in the diagram. The diagram is a cross-section of a solenoid assembly. The diagram is a cross-section of a solenoid assembly. The diagram is a cross-section of a solenoid assembly.

The diagram is a cross-section of a solenoid assembly. The diagram is a cross-section of a solenoid assembly. The diagram is a cross-section of a solenoid assembly.

**TRUE
hermetic sealing
in this new**

**CANNON dc
SOLENOID**

For preformed or custom solenoid assemblies, Cannon's dc solenoids offer positive hermetic sealing, rugged construction, outstanding workmanship and high-quality materials. A precision finished solenoid is built to last and is completely reliable, offering a perfect seal. Other parts are also built. The inner solenoid is then copper nickel-plated and placed in a vacuum chamber. Light immersion provides a perfect seal. Selected No. 1555A shows the first hermetically sealed product of this type. It has a long service life on the dc circuit. Tested with other units, it remains unimpaired after 100,000 cycles. Cannon's hermetically sealed solenoids are used in the most demanding applications in aircraft, missile, engine, and other systems. The diagram is a cross-section of a solenoid assembly. The diagram is a cross-section of a solenoid assembly. The diagram is a cross-section of a solenoid assembly.



Benefits of the hermetically sealed 1555A series, through modification of the winding, can meet various aircraft systems and specific applications within the limits indicated above.

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Since 1918

CANNON ELECTRIC COMPANY, 200 AVENUE 21, CARLSBORO, N.J. 08003
Branches in Los Angeles, Toronto, New York, and Birmingham, England
Address: Cannon Electric Company, Dept. 1, 117 1st Avenue St., Buffalo, N.Y.

STRETCHFORM block of Th-dolaprene highly density neoprene laminate

Butch Henshaw, Henshaw-Richardson, Ltd. The American agent cites these features of Th-dolaprene:

- **Machinability:** The material is easier to handle than many "composites," is self-lubricating in operation and has a low coefficient of friction.
- **Cost:** Cost savings over comparable duct blocks is quoted at 75%—over one inch, 60%.
- **Weight:** Th-dolaprene is 1/10 the weight of steel, 1/3 that of Bakelite and 1/7 that of aluminum. Result is easier handling and more compact stumps with ability to use full height of shoveling which might not support heavier metal dies.
- **Life:** The material gives long product from tool life, and is wear and shock resistant and non-break.
- **Strength and durability:** Compression value of 15,000 psi provides the strength required to form the heavier pipe, machine iron, used in the manufacture of high-speed aircraft and auto parts. Uniformity is assured by using thin, selected, hand-molded sheets whose knots and flaws have been eliminated as much as possible through careful inspection.

U. S. Robbins stresses the fact that Th-dolaprene is not impregnated—it is a "composite." It is a laminated sheet of laminated veneers, reinforced with a synthetic plastic resin film sheet and compressed and heat-pressure bonded to a composite of 15,000 psi. Result is a material which may be treated like laminated—sandwiched with wood working, banded, planed, laminated, drilled and tapped without cutting material. It may be steamed, serfied, polished, sanded, varnished and painted in desired.

- **Block Uses:** Th-dolaprene has been successfully used in such applications as propeller blades for the light and other British lighter and bomber aircraft. More recently, it has been used for landing edge tips for the main and tail rotors of the Bristol 371 single rotor and 375 twin rotor helicopters, U. S. Robbins says. The firm adds that Henshaw-Richardson is currently in production of blades for Bell helicopters and helicopter propellers.
- **Availability:**—Generally, U. S. Robbins



**... with Johns-Manville
THERMOFLEX BLANKETS**

THIS PRODUCTION LINE SCENE in the North American Aviation plant, Los Angeles, shows Thermo-Flex® Insulation Blankets being applied to tail pipes of North American Sabre Jets on order for the United States Air Force.

New standard protection for many Air Force and Navy jet aircraft, these flexible Blankets laminate and protect the engine against searing heat generated by jet power.

Thermoflex Blankets are custom-fabricated with highly mobile Thermoflex RE felt. Developed by Johns-Manville Research and Insulation Engineers, this new standard refractory fiber felt is sealed between sheets of corrosion-resistant metal foil. In manufacturing Thermoflex Blankets to specification, careful attention is given to the accuracy of custom for engine supports, sensor mountings, fuel lines, thermocouple leads



The North American Sabre Jet, protected with the Thermo-Flex Blanket, is shown through the end of a tunnel with lighted lenses.

and other controls. The precision-formed grooving and edges of the blanket... the close fit or custom... insulation maximum insulation value for the entire application. Furthermore, edges at corners are suitably sealed to prevent fuel penetration from the insulation felt.

In addition to insulating tail pipes, engine cases, turbine casings and afterburners... Thermoflex Blankets in special preformed shapes are used to insulate, protect, and fireproof fuel storage tanks, air-conditioning systems, thermal-deicing ducts and many other assemblies in all types of aircraft.

Why not send for your free copy of the illustrated folder IN-156A? It tells the complete story of Thermoflex Blankets for aircraft power plants and airframes. Address: Johns-Manville, Box 60, New York 16, N. Y. In Canada, 159 Bay Street, Toronto 1, Ontario.

Photo: J. M. Co. Inc.



Johns-Manville

**PRODUCTS for the
AVIATION INDUSTRY**



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Resistant for its Silastic

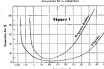


FIG. 1. MOD. VS. TEMP. 200

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Midland, Michigan

BRUNNEN ENGINE SYSTEMS, BELL & HOWELL, LORAN, GARDNER, AIR TRON, MONTAGNA, S. I. (The City, Mo.)
In Canada: (Montreal) Canadair Ltd., Toronto
In England: Midland Airlines Ltd., London

as a resilient
pressure seal for truck
and bus tire valves...

SILASTIC works where other materials fail!

High speeds, heavy loads and sustained operation make truck and bus tires the hottest on the road. Temperatures on the rim and in the valve stem are often as high as 300 F. Organic rubber cap gaskets within the valve core rapidly lose their original resistance, become sticky, and fail to maintain proper air pressure.

The Giff Manufacturing Co. of Cleveland eliminates the problem by using Silastic® cap gaskets in their valve stems. The gaskets remain resilient, maintain air tightness and despite high operating temperatures or salt-water weathering. Giff has made over 2 million valve cores with Silastic gaskets since 1948, and the first failure has been due to deterioration of the Silastic seal has yet to be reported.

Further proof of the usefulness of Silastic as a gasket and sealing material is given in Figure 1. Samples of Silastic and a high quality organic rubber were compressed for 22 hours at temperatures ranging from -67 to 480 F. They were then redressed and measured after 30 minutes at room temperature or at test temperatures where samples were compressed at temperatures below 77 F. Values plotted in Figure 1 show that Silastic retains its resiliency at temperatures for a long and better life than organic rubber.

If you need a resilient material that retains its physical and dielectric properties, maintains water resistance and nonadhesiveness to most sticky materials even after long exposure to weather, contact with a variety of hot oils and chemicals, at service at temperatures from below -100 to above 300 F. TRY SILASTIC.

MAIL THIS COUPON TODAY for more data on Silastic

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Name and title ☐ Silastic Facts ☐ Sources of Supply ☐ "Full Text of Technical Facts"

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plies to maintain in America complete construction of Jet-Subs and Hy-dro-lungs.

Later, if demand warrants, the company will endeavor to manufacture the material in this country.

Hy-dro-lungs are available in two densities.

• **High density**, grade 22/T/82, comes in standard thicknesses of 1/8 in. to 2 in., in 1/8-in. increments, and 2 in. to 4 in., in 1-in. increments.

• **Medium density**, grade 22/T/80, is available in the same standard thicknesses and increments as the high-density material, except that maximum standard thickness is 3 in. instead of 4 in.

However, bands of both densities may be furnished in specified thicknesses other than standard up to 6 in. for the high-density product and up to 6 in. for medium-density material.

Standard size bands measure 8 1/2 in. in other sizes, available in various densities, are 82201, 82, and 54614 in.

Impregnator Seals Porosity in Castings

Impregnation for using styrene-base material to seal porosity in cast aluminum and aircraft parts are being introduced by L. O. Kovac & Bothe, Inc.



Inc. Vanech and was may this be used as an asset.

Castings are placed in buckets which are lowered into vacuum chamber of impregnator. Castings are thoroughly de-aerated prior to impregnating.

Pumping of impregnating solution into tank follows. Then pressure of 100 psi is applied and held long enough to insure complete penetration. Excess solution is drained out through piping at bottom of tank upon completion at process.

Impregnator measures 36 in. in diameter, is made of 1/2 in. carbon steel with 1-in. gasketed cover equipped with weights and provided with counterweights. System is in use plates on bay from counterweights.

L. O. Kovac & Bothe, Inc., 176 Ogden Ave., Jersey City 7, N. J.

PRODUCTION BRIEFING

• **Republic Aviation Corp.**, Farmingdale, N. Y., has leased a building in Hicksville having 30,500 sq ft of floor space, to be used as a tool shop. The facility will be the fourth Republic plant on Long Island, N. Y., and brings the firm's total floor space to more than 2.7 million sq ft.

• **Ade Associates**, Norwalk 2, N. J., has formed a Precision Engineering Division with facilities for design and fabrication of tools, gages, patterns and production tool equipment and to supplement Ade's rocket research.

• **F. S. Stewart Associates**, 16810 Vanowen Blvd., Los Angeles 35, Calif., has been formed to provide chemical research and engineering services in the plastics and related organic materials fields.

MAKE YOUR AIRPLANE PAY THE YEAR AROUND with EXTRA UTILITY, SAFETY, SERVICE and ECONOMY



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USE OUR HIGHEST SKIS AND TYPES OF AIRCRAFT.—The most complete line in the industry. Skis to fit all popular aircraft from light planes to multiengine transport, cargo and military planes.

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FLY ALL WINTER with FEDERAL ALL METAL SKIS

Hydraulically Activated COMBINATION

WHEEL-SKIS FOR THESE POPULAR NEW PLANS

- BEAVER
- CESSNA 140, 170, 182 & 190
- OTTER
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- PIPER Super-Cub, Pacer and Tri-Pacer

Depend on FEDERAL for the finest and greatest advancement in airplane skis. ALL FEDERAL skis sold will meet C.A.A. and new D.O.T. requirements. Get full year-around use from every plane with safe, dependable approved FEDERAL skis. Take off and land on other day snow, ice or bare surface at any time.

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Order now! Immediate delivery skis. Skis are made with military equipment for the military equipment. Federal Aircraft Works has over 10 years of experience in the aircraft field. We have the most experienced engineering people in the industry with various old design and present type in production equipment.

How Parker tank-mounted valves save weight by allowing 25% smaller fuel line sizes

"When you specify fueling equipment, you've got many problems to consider. We believe the best solution is offered by tank-mounted diaphragm valves like these", reports Ernest Badger, shown at right. He is Chief Engineer of the Fuel Division at Parker Aircraft Co.

"You can save weight", Badger adds, "because the lower pressure drop of tank-mounted valves allows you to use about 25 per cent smaller line sizes. Their pressure drop of about 6 psi at 200 gpm is roughly one-half the loss through a similar valve mounted in the fuel line (including exit losses where fuel enters the tank). These savings let you use smaller, lighter lines without reducing the rate of flow to the tank. In addition, tank-mounted valves weigh about 40 per cent less.

"In the nearly 50 years since Parker first started making diaphragm valves, we've never had one rupture in service.

"As for continuous maintenance, there are simply no close fits in this valve or the pilot valve when maintenance might jam.

"The same basic diaphragm valve can easily include a second operating diaphragm unit to perform various functions such as flow proportioning or secondary fuel shutoff protection. Pilot line ports can be located on either the tube-inlet side or on top of the valve.

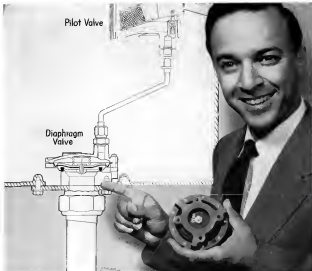
"Parker's pilot valves, like the one shown at right, are available in single or dual valve with many variations. Because these valves are essentially pressure closed, there's no chance for 'hang-up' or 'leaky' operation.

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- ROCKET ENGINEERS
- FLIGHT TEST ENGINEERS
- STEERING ENGINEERS
- AERO-AND-THERMAL/FLUID MECHANICS
- HYDRO-MECHANICS
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FINANCIAL

Collins Typifies Avionics Growth

Sales increase 25% to more than \$80.2 million in a year; backlog reaches new peak of \$255 million.

Rapid growth of the avionics market is illustrated by the new peaks in sales, earnings and backlog listed in the annual report of Collins Radio Co., a leading producer of avionics equipment.

Sales reached more than \$80.2 million in the year ended July 31, 1953, up from 25% from the \$64.3 million of the 1952 period. Net profit after taxes was up 15%, to \$1,953,611, for the 1953 period, compared with \$1,703,651 for 1952. Going effect to the stock dividends of 25% in 1952 and 10% in 1953, a total of 328,499 shares of common stock were outstanding at July 31, 1953. Earnings, on this basis, aggregated \$4.63 per common share for the 1953 fiscal year, compared with \$3.87 on the adjusted capitalization for the 1952 period.

► **Tim Tull**—The report shows that three last, more than double the residual earnings for the stockholders in 1951. Collins paid dividends on common stock of \$1.00 per share in 1951. Without regard to other adjustments, which are unknown, following the liabilities, the excess profits were paid to the company last fiscal year total to be \$4,205,768, equivalent to about \$3.36 per common share. Total taxes were \$4,732,405.

The hope of EPT (its calendar year will prove beneficial, but only for the seven months of the current fiscal year. However, these benefits may be offset in the future by contingencies or available earnings, although the company is optimistic.

Study of the report indicates that Collins has been able to obtain an overall price on its contract price reduction processes. This may be their last inducement to the management's expansion that responsibility for the 1951, 1952, and 1953 fiscal years will result in "no significant changes." The company shows its debt balance sheet as of July 31, 1953, at \$233,064, representing a 10% price reduction. Last year (the 1952) a similar ratio was shown at \$248,786.

► **Profit Margin Drops**—Net profit margins on sales show a continuing decline, being 2.4% for 1953, 2.6% for 1952, and 3.4% for 1951.

Net net worth rose at a new high at July 31, 1953, aggregating \$9.2 million, equivalent to \$18.96 per common share, and comparing with \$7.5 million a year

earlier, or \$15.91 per share on the adjusted capitalization.

Unfilled orders at July 31, 1953, were also at a new high, \$255 million, compared with \$199 million a year earlier, despite heavy deliveries. To finance its requirements the management reported during 1953 \$13.7 million of its \$15 million 8 1/2% senior Working capital of more than \$5.9 million was shown as of July 31, 1953, an increase of \$900,000 during the year.

► **The Intangibles**—As with all leading engineering and development companies, considerable sums of an intangible nature are reflected in the financial statements but not always clearly indicated.

Significantly, the company's annual report shows:

"Our production programs are founded entirely upon the development of new engineering and research laboratories and represent significant investments in the construction and improvements of the company's equipment."

► **Device Questions**—Still another source of the report reveals the diversity of the company's programs and its new government customers.

These agencies include the Navy, Air Force, Army Signal Corps, Justice, Treasury, State, Commerce, Interior, Defense, and the Atomic Energy Commission. Since 75 different equipment or equipment systems—developed by Collins—were being produced by the company and a dozen other major electronic subcontractors for these various government departments, the report shows.

► **Commercial Business**—While the government is Collins' chief customer, commercial sales are also reported to be in a strong position. Management estimates that about 75% of all air transport communications and navigation equipment purchases during the year were of Collins manufacture. The avionics industry last developed into the largest single commercial market for the company's equipment.

New products in other fields are also becoming more prominent. For example, a stronger market for replace-

ment broadcast equipment is developing in that industry is faced to compete with television. Sales in 1953 increased materially over those of the previous year with a substantial volume of transmitter licenses looked for delivery in the current year.

Research and engineering development expenditures remain high, being about \$10 million in the 1953 fiscal year. But it is this research effort and expenditures which is primarily responsible for management's assertion that more than \$800 million of Collins-designed equipment has been subcontracted or put on order since World War II.

—Selig Atwater

Northrop Net Rises While Sales Drop

Net profits rose while sales dropped in the fiscal year ended July 31, 1953, Northrop Aircraft, Inc., reveals. The apparent contradiction is the result of a special tax credit.

Total sales for the 1953 period amounted to \$164.2 million, compared to \$187.5 million indicated for 1952. Net income before federal taxes was \$6,851,799 for fiscal 1953, against \$7,453,440 in 1952. In other words, operating earnings were somewhat lower than last year.

Net income after taxes amounted to \$2,318,199 or \$3.64 per share in 1953 compared with \$4.22 the year earlier. However, special tax credits resulting from adjustments of prior years' operations were included in 1953 accounts and amounted to \$1,622,117, or \$1.94 per share additional.

The Northrop management revealed a backlog of \$186 million at July 31, 1953, with additional contracts of about \$197 million in the process of negotiation.

Net worth of the company improved to more than \$12.4 million, or \$19.36 per share at the 1953 fiscal year-end, up from the \$9.6 million, or \$16.65 per share a year earlier.

► **Credit Arrangements**—To help finance its requirements, Northrop has a \$13 million credit agreement under which it has agreed to assign all claims for government contracts. Of this credit, \$10 million was drawn down. Also outstanding were obligations of \$2.8 million due the Rocketdyne Division, General Corp. and about \$628,800 notes payable moved on the acquisition of its subsidiary, the Radioplane Co.

The company's annual report reveals that its principal contract, the F-89 Scorpion, "is expected to secure standard Air Force equipment for some time." Also, management expresses considerable hope for its guided missile development and production—SA.



Northrop's Prime Equation

Northrop Aircraft produces specialists in remote and small time saving methods. The "hot-shut" assembly technique, illustrated above, permits fast installation of equipment in Scorpion F-89 aircraft now in production. Equations are used to solve problems. At Northrop Aircraft, the prime equation combines state-of-the-art science, outstanding scientists, and production specialists with modern industrial and research facilities. The combination efficiently converts imagination and knowledge into actual material of advanced design and needed value.



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Pioneer Builders of Night and All Weather Fighters

What JACK & HEINTZ is doing about...

J&H announces development of three new 8000-rpm, continuous-duty, d-c generators for jet aircraft—unique "straight-through" air path design provides maximum cooling.

High-speed accessory pads on current jet engines create the need for a generator which can operate continuously and efficiently at 8000 rpm. Present generators, designed primarily for use on reciprocating engines, do not meet that demand—high temperatures and stresses greatly reduce service life of bearings, commutators, brushes and insulation—making new generator development a vital necessity.

Responding to this need, J&H is the first manufacturer to announce development of essential high-speed, d-c generators for use with jet aircraft engines. All models are "true" 8000-rpm, continuous-duty, d-c generators.

J&H engineers, in developing the new units, have refined conventional aircraft generator design to include:

1. Elements capable of withstanding higher operating temperatures
2. Greater heat transfer areas to reduce heat flow resistance
3. Design changes to reduce heat losses

Maximum cooling is provided through one of the most unique features of the new units, a "straight-through" air path that allows free air passage under the commutator and through the armature.

Specially designed blast caps are available to meet specific airflow requirements or to effect reduction in over-all generator dimensions.

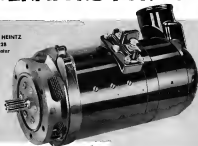
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GENERATORS FOR JETS

JACK & HEINTZ
Model G125
d-c Generator



JACK & HEINTZ
Model G124
d-c Generator



JACK & HEINTZ
Model G131
d-c Generator

DESCRIPTION	MODEL G124	MODEL G125	MODEL G131
Basic specifications*	MS-G 6142	MS-G 6143	MS-G 6143
Output rating at 50 v	300	400	400
Speed range (rpm)	3000-8000	3000-8000	3100-8200
Cooling air pressure (lb. of water)	6	9	12
Engine mounting pad	AHD-2002B	AHD-1800A	AHD-1800C
Length (in.)	19 1/2	25 1/2	14 1/2
Diameter (in.)	4 1/2	5	5 1/2
Weight (lb.)	64	81	64
Over-hang (inches) (in.)	240	430	430

*Based on Jack & Heintz mounting flange

J&H looks to the Future

In addition to the d-c generators described, several new a-c generators will be available soon. This group of alternators includes:

G161—a 50-kva, 1500 to 12000-rpm air-cooled unit

G22—a 95-kva, 6000-rpm air-cooled unit

G16—a thermalizing unit with a magnetic amplifier regulator

G16—a 50-kva, 6000-rpm unit

G16—a 50-kva, 6000-rpm unit developing 120 kva with air pressure of 6" water, 160 kva with 12" water

J&H engineers will be glad to work with you in developing aircraft electrical, mechanical or hydraulic systems to meet your special requirements. Write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio.

*All dimensions subject to change without notice

Rotomotive EQUIPMENT

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VIBRATING: the a reading lock, vibrates does work of a gyrocompass. Capt. A. C. Pickett of Baker shows unit to F. H. Goring (center), Baker, and R. E. Rosinsky, Sperry.

this observation, was actually due to company and safety issues.

► **Vibrating advantage:**—There are some of the advantages which Sperry and the Navy use for the new device.

► **High sensitivity:** Lack of bearings used in conventional gyros, and associated outside friction, gives the vibrating gyro an extremely high sensitivity. Response times in the order of 0.005 second or lower can be achieved.

► **Wide range:** The vibrators can cover a both extremely small and large angle rates, covering over a range of more than one million to one, with good linearity, Sperry says.

► **Reliability:** Absence of bearings and

dynamic balance problems makes device extremely rugged and able to withstand high G's.

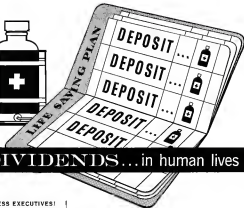
► **Single-axis sensitivity:** The vibrators is sensitive only to angular velocity about a single axis; applications about any axis do not introduce steady state errors.

► **Self-synchronization:** The vibrating gyro can be self-synchronized without corresponding loss of sensitivity experienced in conventional rate gyros.

One strike against the vibrators is that, unlike conventional rate gyros, it requires the use of a small amplifier. However, Sperry engineers point out that the amplifier can be designed to use rugged magnetic amplifiers, to cause



INSTANTANEOUS relative between position of vibrating rotor and lower handle (shown by sketches, left) occurs when vibrators rotates in opposite direction (right).



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- ☐ ARE YOU INFORMATION GIVEN THROUGH PLAIN SUGGESTION OR HOUSE MANAGEMENT?
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EXPERIMENTAL AUTOLOID using spray vibratory is tested in Navy R&D

the device extremely reliable.

► **Principle of Operation**—The vibratory, like its rotating counterpart, owes its operation to the principle set forth in Newton's first law of motion: a body in motion will move uniformly in a straight line until acted upon by some external force. This vibratory principle can be demonstrated by grasping the handle of a vibrating tuning fork and holding the fork about its vertical axis (passing through the handle).

As the fork is rotated, its handle exerts a small torque (against the fingers) which oscillates at the same frequency at which the fork is vibrating. The faster the fork is rotated, the greater will be the torque. Thus the magnitude of this torque is a measure of the angular velocity at which the fork is being rotated.

► **Magnitude Plus Sense**—If human perception were fast enough, it would be diagnosed as the nut is being rotated that when the tuning fork turns (in bearing demands) as at one extreme of their travel, the direction of torque exerted by the fork handle is in a clockwise direction; at another instant, when the fork is at the other extreme of travel, the relation between torque and rotation direction is reversed. Again, if the direction of rotation of the nut is reversed, the relation between the two positions and direction of torque is reversed.

► **Getting a Signal**—An arrangement is needed which indicates the handle torque and establishes its direction relative to the position of the vibrating fork at any instant. In practice, the tuning fork handle is designed in a manner but so that it will vibrate at the same frequency at which the fork vibrates.

When the vibratory nut is rotated, the oscillating torques generated will



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cause the torsion bar to oscillate through an amplitude proportional to the angular velocity at which the unit is being rotated. To measure this torsion bar rotation, a small metal vane is attached to the torsion bar, and electrical pick-offs are located on either side of the vane and fixed to the gyro frame (see sketch, p. 37). When the gyro is stationary, the vane is centered between the two pick-offs and there are output signals in zero. When the vibratory is rotated, the torsion bar and vane oscillate, generating in the pick-offs an oscillating signal whose peak amplitude is proportional to the amplitude of vane rotation, and hence to the angu-

lar velocity of the gyroscope shell. In order to establish whether the gyro's angular motion is in a clock-wise or counter-clockwise direction, an other set of electrical pick-offs is mounted near the vibrating mass. These pick-offs generate a reference signal to determine whether the mass can be one or the other extreme of their travel.

Demodulation of the torsion pick-off signal relative to the two pick-off signal produces a d.c. output signal whose amplitude is proportional to the vibratory's angular velocity, and whose polarity is determined by its direction of rotation.

► **Driving the Forks:** The signal from

the two pick-offs is addition to serving as a reference, is amplified and used to power a set of drive coils which keep the turning fork in a continuous state of constant amplitude vibration. The drive coils serve only to supply energy lost during each cycle of fork vibration and maintain bar oscillation. (Turning fork frequency is established by its physical dimensions, type of material, etc.)

The response time of the vibrating gyro (to a change in angular velocity) is inversely proportional to the oscillation frequency of the torsion bar, and hence to the turning fork vibrating frequency. To get fast response, the turning fork frequency is normally at least in the upper audio range. This also provides greater resistance to any shock or noise vibrations which are of lower frequency.

Tuning fork frequency and torsion bar design are selected to give the vibratory the response time and sensitivity required for any specific application. To maintain the device's linearity, the drive amplifier must be designed to maintain fork vibration at constant amplitude.

► **New Design Problems:** Although the vibratory eliminates some of the design problems associated with conventional rate gyros, it imposes some new ones. For example:

• **Linear fork drive.** Electrodrivers which drive the tuning fork must be carefully aligned to prevent imposing any twisting couple to the fork mass. Any such couple will create spurious torque on the torsion bar.

• **Time balance.** Tuning fork times must be dynamically balanced to prevent vibrations at right angles to the main vibration mode.

• **Rigid structure.** Assembly must be designed to prevent distortion due to temperature change or aging.

• **Shielding.** If tuning fork assembly is connected outside from magnetic material, and is to be used in the presence of static magnetic fields, it must be suitably shielded.

► **Considerable Problems:** If the foreign conditions are such, the vibratory offers considerable promise. It is well suited to rotation to shock and vibration damage. Such engineers may find it cumbersome in a hermetic enclosure, it should be set in a base, since mechanical elements are exposed will be low the value of this bridge color once built.

The vibratory's extreme sensitivity and high output rate make it possible to obtain a desired rate of change of variable directly, or acceleration signal. This in turn should make it possible to use the vibratory as a displacement type, whereas by using a high-gain servo system to drive the instrument as to maintain it at a fully new rate of rotation.

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EQUIPMENT



NORTHEAST'S CONQUEST IIJET averages 125 landings and takeoffs per hour.

NEA Solves Shorthaul Problems

Carrier must put special emphasis on tire and brake care as a result of frequent landings and takeoffs.

By George L. Christian

Boston-Northeast Airlines' officials sometimes refer affectionately to their company as the "Shorthaul Airlines." Takeoffs and landings at NEA's fleet average 152 per hour for its 12 DC-8s and 125 per hour for its six Conquest IIJs. This includes relatively long hauls, such as non-stop flights between New York and Boston, and New York and Montreal, Quebec, which take as long as seven days. NEA probably averages the shortest hauls of any U. S. scheduled carrier.

■ **Shorthaul Problems**—The inherently shorthaul character of its operations makes Northeast particularly performance-conscious of its plane's tires and brakes.

Here is a summary of the company's experience with these components: ■ **Tires** NEA is very pleased with Goodrich's diaphan tread tires. These tires "lasted for us considerably longer than the 14k," says D. W. H. MacKinnon, the company's senior engineering and maintenance. The airline is currently testing U. S. Rubber's "Eveready" security tire. The units look good, but tests are not conclusive.

The Goodrich diaphan tread has lasted an average of 900 landings, compared with 600 for conventional tread. NEA has set a limit of four retreads on the main gear tires of its 380s and DC-8s and on aircraft for the Conquest main gear. Retreading is done by the manufacturer, independent jobbers and by Thompson Aircraft Tire Corp., San Francisco.

■ **Brakes** Goodrich's integral brakes on the Conquest work well, according

to airline spokesmen. The carrier is in the process of testing new keyhole-shaped ones on main (nose) side of the brake, which is the shorthaul brake lag. Previous ones had been round and wore faster than the corresponding lag on the opposite (tail) side. The keyhole spot, by increasing brake lag on the inner side, is expected to equalize the wear.

The Goodrich expander tube brakes on the DC-8 take quite a beating since the -3s are used as the shorthaul of NEA's flights. But they stand up to the stress. Brake blocks are good for 3,000 ft., equal to about two run-outs. The Runways-3s in most airlines, NEA demands its own, home-made measure to ease the tough job of landing. The brake wears from wheel runs. This unit is particularly simple, efficient and cheap. It breaks free very from both wheel's run circle, with 1/4 the effort on the part of the operator, in less than a minute.

Operator places wheel with tip on a horizontal, movable platform which is cradled into the machine's bed. A circular metal cage is placed on the tire's head. Band on underside of tire is also placed. Flange of a switch starts an electrically driven hydraulic pump which sends an oiling gun rotating cylinder to push down cage and break tire head away from wheel. An integral hand switch begins by disintegrating the wheel, the rotating cylinder when it reaches full travel. Throwing switch the other way returns components to rest position up for next wheel.

■ **Flack Map**—In a small office, where the number of shops is held to a minimum, there are always three racing

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ELECTRONIC DIVISION

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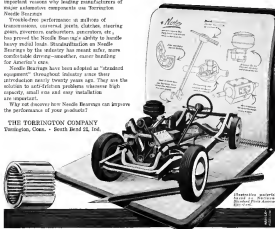
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a lifelike and loading check hat made of laminated felt is worn. The check hat is a grid with a black face, white center and red backing. The lettering, cut through the black, shows up white during the day. At night, lettering color may be varied from pure white to brilliant red by changing intensity of lighting on the back of the panel.

To check all stems, cockpit pushes a slide from one side of the unit to an other to indicate that no stem has been checked. Pilots say this is much better than the old type of check, but somewhat awkward. With the slide type, stems may be taken in any sequence, check list is complete when all stems are on one side or the other of the panel. With a roll type, the list has to be rolled back to pick up any stem called.

Around the Shop: A tour of NEA's most shops here brought out these facts:

• **Exhaust stack fig.** NEA has a good solution to the often vexing problem of assembling exhaust stacks normally. It constructed a fig. of a disassembled engine crankcase and installed disassembled cylinders. Here, for practical cutting, was an accurate fig. on which the mechanics could build up exhaust stacks which would fit on engines the first time.

• **Heater conversion.** Northland's fleet of 24-passenger DCs is now being converted from the old boiler heating sys-



Lightweight Ramp

New-style, lightweight, portable loading ramps being put into service by Western Air Lines feature all-american fabrication for lightweight and non-synthetic construction for strength. They incorporate battery-powered lighting system, permanently lubricated wheels and casters, and a special foot locker to lock the ramp in position. The ramps may be assembled in slightly different ways by Tolley Manufacturing Corp., 11 Inglewood, Calif.



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from the **Normalized** function

• **Engine overhaul time.** The B7510 cannot on NEA's DC7s have a 1,000-hr overhaul period, its Convair B7500s at 1,100 hr.

• **Flag overhead time.** The airline says Champion RJ75s plug in all its engines. Flags are pulled at 750 hr, and are normally available for two years.

• **Analyses.** NEA uses two Scintillate portable analyzers and all of its 200s are used for the units. Analyses are used in circulation and at each No. 1 (77 lb.) chuck.

- **Temporary worker** To keep its warehouse busy, Northeast performs seasonal work on a winter basis.

for these stamps that come in to Boston: Trans World Airlines, British Overseas Airways Corp., and Mohawk Airlines. It performs special service for black and others.

• **Ornate and kind.** Of its fleet of six Convair 440s, NEA owns three and leases three from Pan American World Airways.

NWA Finds Fix for Wing Bolt Corrosion

Northwest Orient Airlines' systems engineers have found a quick, relatively easy way of controlling a problem that



ENDOSCOPE is used to examine deep space within body holes for carcinoma.

has benefited airlines ever since the inception of the retail airplane-purchase contract.

In this case, the corrosion was occurring between the aluminum main wing spar and high strength steel splice bolts at NWA's Boeing Stratocruiser. Corrosion resulted from electrolytic action set up between the two dissimilar metals.

- Inquest wing spot splurged with a "horoscope" (an optical instrument)



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• Calamine plate the spot bolts.

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OFF THE LINE

Emergency cabin lighting system, to be installed in Northwest Airlines' Super Constellation and DC-6Bs, will keep 12 large gong fire extinguishers 30 inches from emergency exits will come from dry cells located in a protected area of the aircraft ceiling and will be connected on interlocks in one of two series. Bakers NWA is also experimenting with a deactivation switch to turn on the emergency system on sudden impact. Lockheed Aircraft Corp. is installing the light system on the ten 104th Super Constellation that are in use, Grand Central Aircraft Co., Glendale, Calif., is handling the work on the four DC-6Bs. NWA is getting the DC-6Bs on long term lease from Flying Tiger Line, which recently ordered them in the aircraft DC-6A (Liberator can be replaced).

Pacific Aircraft Corp. has signed separate contracts and licenses with the British firm, Sir George Colclough & Partners, Ltd., which gave PAC early on rights to manufacture and distribute Colclough aircraft protection equipment in the U.S. PAC plans to combine Colclough units with protection and temperature control equipment recently manufactured by PAC into complete air conditioning systems for U.S. commercial aircraft. The complete systems will include an approximately 20% Colclough equipment and 80% PAC-made units.

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COPPER CONTAINER—Figure B, lead wire to specification AEW-1. Available in type II or III wire as shown. Thermocouple wire supplied in AWG sizes from 18 to 20 or 22, 100 ft. length.

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Developed for Lockheed, the ANALOG I indicator (shown) is used to indicate the internal pressure resistance of one inch each in right hand.

ANALOG II
Standard analog read pressure (the ANALOG I pressure) is used to indicate the internal pressure resistance of one inch each in right hand.

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A new passenger loading ramp, designed for use on Lockheed Super Constellation, Boeing Stearman and Douglas DC-4, DC-6 and DC-7, is being marketed by Teum Metal and Manufacturing Co., Inc.

The unit is 224 in. long, 94 in. wide, has a maximum overall height of 175 in. and a maximum overall height of 118 in. It weighs 2,500 lb. Price is \$4,700.

Height of upper platform is regulated by means of hand-operated hydraulic pump and a 110 psi hydraulic line to accommodate aircraft with maximum varying from 80 to 110 in. from ground. Accurate location of platform is insured by hinged steel rollers located on either side of hydraulic line. Cast-steel locking lock in position.

The steps and platform are covered with safety tread and illuminated by 175-watt lights. Ground is illuminated by 175-watt lights. Lights on under side of platform are in prewarning at night. They can be operated from wet cell battery in the fuselage or from aircraft power outlet.

Teum Metal and Manufacturing Co., Inc., Dallas, Tex.

den for aircraft electrical systems

Designed as a lightweight unit for obtaining instant current for d.c. equipment, the transformer rectifier is used to convert ac power to d.c. for use.

Equipment for unit consists of automatic rectifier, transformer, variable resistor regulating network, cooling fan and aluminum casing.

Schermund is a high-temperature unit manufactured by GE's transportation process. Transformer, designed specifically for aircraft use, incorporates grain oriented steel to make it lighter.

GE engineers say voltage regulation is held to within plus or minus 0.5% in all units. Regulator is 44%, efficiency 77% maximum, and power factor approximately 75%.

Units now available have ratings of 10,000 and 100 amp, 6 or 24 v. Weights range from 17.5 to 67 lb. All units meet aviation specification MIL-E-3273.

General Electric Co., Lighting and Rectifier Dept., Schenectady, N. Y.



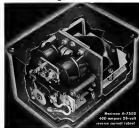
Regulator Guards F-84 Hydraulic Pressure

United Aircraft Products, Inc., in manufacturing a new hydraulic regulating valve designed for protecting the hydraulic pressure tank in Republic F-84 and F-84B, but which may be useful in other aircraft.

Manufacturer states that unit maintains maximum regulated pressure in tank during field level change, protecting against excessive pressure caused by tank pumping of fluid, through aerodynamic of fluid valve.

Atmospheric pressure, applied through a vacuum venting valve, prevents against vacuum condition being created in tank. A check valve in the regulator prevents further pressure by preventing air or hydraulic fluid from bleeding back into upstream lines during

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Cessna 340, Douglas DC-6B and DC-7 aircraft. For the new Hartman reverse current cutout and connectors have an interrupting capacity greater in excess of all requirements from sea level to 30,000 feet.

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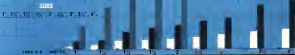
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WEIGHT COMPARISON CHART



Source: <http://www.fishbase.org>

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L. B. WOODS & SONS COMPANY, INC.
204 East Olympic Boulevard, Los Angeles 21, California

percent power before or engine shut down.

Body of unit is made of cast aluminum. Component parts are of fabricated aluminum, excepting stainless steel venturi, diaphragm and seal.

Operating temperatures are rated 65°F to plus 250°F. Inlet air pressure range is 15 to 180 psig, while regulated pressure is 5.5 to 6.5 psig, with 0 to 1 cfm flow.

Relief valve cracking pressure, on test oil, is 12.5 ± 2 psig. Cracking pressure of maximum relief valve is from 0 to 2 psig.

Unit weights 76 to All ports table
AND 100/90.6 ft/meters

United Aircraft Products, Inc., P.O.
Box 1695, Dayton 1, Ohio

New emergency flares being marketed by Air Associates is self-contained, needs no auxiliary power for firing. Outer cylindrical container serves as rocket launcher. Flare reaches minimum altitude of 1,500 ft. and provides an light of 10,000-candlepower for at least 30 seconds.

Wheel-center assembly being produced by Aerial Co. is 18 in. in diameter, suitably strong, dural, shock-absorbing unit for use on ground handling equipment. Special feature is no seal assembly inside which permits vibration free operation at high speeds. Weight is 75 lb., construction is cast heat-treated 356 aluminum. Unit was developed for Republic Aviation Corp.—Aerial Co., Los Angeles, Calif.

Flareless fitting, available in sizes from 1 to 3 in., holds twice the tube-bending pressure (up to 50,000 psi) depending on size and wall. It is tight-cured to a positive stop action, with no tube cutting or gouging action. Assembly is accomplished by insertion of tube



in fitting, tightening with wrench. By replacing sleeve, fitting may be reused. Available in steel, brass, aluminum and stainless steel. Meets requirements of specification AN-3-47 and MIL-F-3936A. Manufacturer of the firm is Alameda Fitting Co., 1400 E. 76th St., Cleveland, Ohio.

AVIATION WEEK, November 29, 1952



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LORAIN, NEW YORK

AA Calls Ducted Fan Key to Jet Airliners

- Analysis director spells out airline's engine views.
- But builders say proposed turbine is years away.

By William J. Conklin

Los Angeles-American Airlines believes the ducted fan engine may be "the key that opens the door to widespread use of the commercial jet transport," Harold E. Hohen, AA director of aircraft analysis, told a group of engineers here Nov. 12.

Hohen also spelled out in detail the carrier's views on turbojet and turbo-prop transport aircraft.

"Our answer to the question of turbojet or turboprop is neither, for the present, unless our hand is forced by competition," he said.

• **Ducted Fan:** Hohen's thinking on jet transport was detailed in a paper prepared by Hohen and W. C. Lawrence, AA director of development engineering. It was delivered by Hohen at a meeting of the Southern California section of the Society of Automotive Engineers.

Presenting officials of Douglas Aircraft Co., Lockheed Aircraft Corp., and Boeing Airplane Co. were on hand to debate the airline's position. Most of these several companies favor the turbojet engine, except for the latter in the future to a certain extent.

"It is a choice for something that is more, more, more," announced George Snyder, chief of preliminary design for Boeing.

Snyder said his company also believes the turbojet engine has no future as the airline's engine.

• **Chief Objections:** Hohen said American's chief objections to the turbojet engine are its excessive cruising, excessive fuel consumption, relatively low takeoff thrust, and the noise produced at high power near the ground.

Objections to the turbojet engine are complex, of control and noise problems in cruising flight within the passenger cabin. Lack of a desirable turbo-prop engine at present is another factor, he said.

• **Compromise Configuration:** "What we are waiting for is further development," stated the AA official. "The wait may not be so long as one might think. There is a third configuration of gas turbine engine, which can be visu-

Average Operating Costs of Jets vs. Pistons

(Cents per plane-mile)

	Proposed jet transport aircraft	Today's transport aircraft
Flight crew salaries & expenses	\$1.9	\$1.1
Fuel oil & taxes	45.4	32.6
Insurance (liability & property)	7.1	1.2
Total flying operations	54.4	34.9
Aircraft maintenance and overhaul	12.0	13.7
Engine maintenance and overhaul	27.6	16.5
Total flight equipment maintenance direct	39.6	28.2
Depreciation airplane	16.5	12.6
Depreciation engine	9.1	7.3
Total depreciation flight equipment	25.6	19.9
Total direct flight expense	149.3	93.1

Turbojet, Turboprop Comparison on 1,000-Mi. Flights

	Turboprop aircraft	Turbojet aircraft
Estimated costs		
Flight crew salaries & expenses	\$1.9	\$1.4
Fuel oil & taxes	35.3	41.4
Insurance (liability & property)	7.1	7.1
Total flying operations	44.3	50.9
Aircraft maintenance	12.0	12.6
Engine maintenance	18.0	27.8
Engine overhaul	0.1	
Total flight equipment maintenance direct	30.1	39.8
Depreciation airplane	19.2	15.5
Depreciation propeller	11.7	0.1
Total depreciation flight equipment	30.9	15.6
Total direct flight expense	105.2	146.3
Ratio per mile costs	1.00	1.46

alized as a compromise between the piston and jet."

"Yes, he said, is the ducted fan, or bypass engine."

"So this means a gas turbine engine, possibly a two-shaft arrangement with a large and relatively low-compression front compressor stage. A portion of the air from this compressor bypasses the combustion chamber and turbine

and is accelerated to the rear through an annular nozzle surrounding the jet pipe."

"This results in an intermediate propulsive efficiency, he said. Compression jet velocity is reduced by extracting an additional increment of energy by means of the turbine, but this energy is then used to accelerate an additional quantity of air, thereby, or bypass air, to

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can be forced. No metal. No electricity. No distorted radar signals.

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approximately the same reduced velocity," Johnson adds.

► **Advantages**—"The result is a payload efficiency, and therefore a specific fuel consumption, somewhere between that of the jet and that of the turboprop engine," Hobbs commented.

"Normally, its weight will be increased over that of a comparable jet engine, but this should easily be offset by reduced weight of fuel."

The latest advanced advantages are:

- **Large thrust**—due to the ability to augment the basic gas generator thrust is most pronounced at low forward speeds.
- **Lighter, better-proportioned aircraft** as a result of the increased inlet power.
- **Reduced noise level** due to reduction of the jet velocity to perhaps one-half the velocity produced by a jet engine driving itself.

Hobbs said it appears that such a powerplant of the right size would be useful not only for a commercial transport but also for any military application where jet aircraft may be ground for range.

► **British Development**—"Raman has it—and all we know of this is what we read in the British press—that an engine of this general nature is under intensive development in England, by a company of very good people," he remarked.

Chief engineer Kelly Johnson of Lockheed commented in rebuttal that the U. S. military carried on some de-fragment work with the ducted-fan engine but found it was not practical for military aircraft because, while very effective at a given Mach number, it was not efficient for overall speed range.

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"Perhaps it might be a good transport engine," Johnson added, "since the jet transport will be flying just under Mach 1 for the next 15 years."

But Carlos Wood, chief of preliminary design for Douglas, questioned the economy of the ducted-fan engine and commented: "Although we have made to increase the military and marine interest in ducted fan but nothing has been done."

► **Feasible**—Falcon—Regarding the turboprop engine, Armstrong, who said that the truly high-speed turboprop is not within the present state of the art of transport design and will be practical within the immediately foreseeable future, according to Hobbs.

This seemed to conflict somewhat with statements made recently by other officials of the airline.

Hobbs made these three points on engine turboprop:

- **The good position of the speed control** required over a wide range of forward speeds and engine power has led to an intricate system of controls to coordinate the propeller with the engine.
- **It is usual** light configurations, the propeller is the dominant control. During landing, the transition becomes too demanding for the propeller, and the dominant control becomes the engine.
- **Low** leads to a very much more complex powerplant control system than those with which we have had experience.

► **We are not entirely satisfied** that it will operate with the reliability which has been characteristic of reciprocating powerplants.

► **The turboprop engine** under consideration represents the highest state of the art in aviation gas turbine engine development to date, and, further, it is scheduled for large-scale production. Consequently, its efficiency is very high for its type, and its price, because of mass production, is actively low.

► **The turboprop engine** under consideration, on the other hand, is slightly underdeveloped as design, and will be produced only in small quantities. Accordingly, its specific fuel consumption, as well as its price, is higher than might be expected.

► **While use of an "ideal" turboprop engine** would obviously further reduce the costs of the turboprop airplane in the study, he said, no such engine will be available in the near future and "hence we find that such an assumption would not be valid."

► **Turboprop Performance**—In his remarks on turboprop, Hobbs listed these as the characteristics of the up-to-date turboprop transport airplane currently produced by several "imperfect" U. S. manufacturers:

- **Climbing speed**: 350 mph.
- **Climbing altitude**: 35,000 ft. and up.
- **Range**: 3,000-miles-per-hour flying.
- **Engine**: four of most advanced twin-

► **Noise and vibration** within the cabin has always been a problem in propeller-driven airplanes. Experience and all available information lead us to believe that this problem will become more acute as power and forward speeds are increased.

► **The result, we suggest, will be a compromise in the case of the turboprop airplane under consideration. It will be difficult, if not impossible, to make the improvement in comfort which we desire.**

► **A most important consideration is the selection of new equipment in its probable case of service. This could be quite short in the turboprop airplane in competitive service.**

► **We suggest that this engine** might almost immediately be made acceptable for civilian service—perhaps by a jet airplane which offered greater passenger comfort and faster schedules without increase in fare.

► **Cost Comparison**—The A4 analysis introduced a comparison of turboprop and turboprop costs that showed a turboprop cost of 1.00 for the turboprop against 1.00 for the turboprop.

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Artist's Conception of Douglas DC-8

Douglas Aircraft Co.'s present DC-8 jet transport design has a package very similar to its DC-5 and DC-2's wings. Wings are swept back 30 deg., with its four jet engines

mounted in pods projecting well forward of the wing leading edge. Tail design somewhat resembles that of Boeing's upcoming B-47 Stratofortress medium bomber.

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Helen said the small jet engine, particularly when mounted in pods, now offers considerable promise of equivalent performance to that of present piston installations.

"With regard to the engine and its equipment, we have some reservations," he added. "Early types of high-speed aircraft built, on some cases, demonstrated seriously deficient control characteristics at speeds only slightly above those of normal cruise."

Calculation of engine needs must be made more reliable for flight above 35,000 ft than jet systems developed to date, he said.

■ **Personal Battle.**—"We have no real doubt that safe and reliable jet airplanes can shortly become available," the editor offered comment. "Meanwhile, America's acceptance of helicopter aircraft is financed, he said, with care. Public acceptance of the same level is another hurdle."

"It must be realized that such a replacement fleet of 10 or 12 airplanes, with spare and ground facilities, will require an investment of about \$30 million," Helen said. "At the same time, it cannot afford to make any serious mistake. We must be convinced that the airplane is right in design philosophy and right in detail design before any such commitment is made."

■ **Latest News.**—America's study of jet power during Iceland has been most discouraging, according to Helen.

None, he said, is an inherent quality of large turboprop engines and not likely to be reduced state of radical redesign of the engine.

"There is reason to expect that an ongoing sound level during itself will affect at least twice the ground noise now involved," he estimated. "We doubt that the public is in a frame of mind to tolerate this increase, perhaps, but at metropolitan airports in the eastern portion of the country. We are reluctant to be the first to put this theory to the practical test."

■ **Present Plans.**—A consideration of large payload aircraft for crewless and very large weight of fuel required for jet engines will necessitate aircraft gross weights of 200,000 lb. or more for transcontinental coast-to-coast flights, Helen forecast.

"Unfortunately," he commented, "many reasons at airport airports are assigned in length at structural strength at such gross weights."

Helen said a study of America's attitude toward the jet transport this way.

"As a flying machine, we like it, we should like to offer the improved service that it can provide. But, frankly, we are afraid of its price, its size, its appetite for fuel, and its noise."

"This feeling may change with further development or with more experience. I could honestly change very quickly if some bold individual were to fly jet transports for operation in a competitive route."

"There is nothing bad or unsolvable about our position, but for the present we are not eager to prematurely jeopardize the jet transport."



British Airlines Bid for Princess

By Ned McKittrick
(McGraw-Hill World News)

London—Scandinavia-Rac's large 30-engine Princess jet, long lost, possibly as a second-hand for the very long, got a new lease on life this month when Aquila Airways expressed interest in the big plane.

Aquila, Britain's only flying boat op-

erator, told the government it would be willing to pay more than \$5 million each for the Princesses—seven new engines are available.

And British Overseas Airways Corp., topped off headed for the Aquila offer, and took down several aircraft in the big flying boats.

■ **White Elephant.**—Like Britain's big British Overseas, the Princess had been

considered a white elephant, and many said it would be junked along with the Britannia.

After spending \$10 million on the Princesses, the British government now sits with no customers, one flying boat with an inadequate engine and two other airplanes in mothballs.

Wrecked of this new quest of public, is certain to keep the big flying boats intact for a while longer, at least. However, it will be sometime before anyone can operate them.

■ **Atlantic Transport.**—Aquila, which this year merged with British City Airways, British airline service, operates trans-Atlantic short flights and a short-haul jet to England flying out on routes between Southampton and the Mainland and Canary Islands. The airline soon will announce a service between Southampton and Cape.

Aquila won't say exactly when it will start to operate the Princess, but it certainly is looking further ahead than its present routes, but for trans-Atlantic service, perhaps to the West Indies.

The Princess, with its present Bristol Proteus 2 engines, is designed to carry 100 plus passengers, 5,500 mi. With the right engine, it could carry 200 passengers at a cruising speed of 5,500 mi.

■ **Wanted With Strings.**—Aquila made the offer in response to a questionnaire sent out by Britain's Ministry of Supply, legal counsel of the Princesses BOAC apparently head of the offer before it was made public, close out with this announcement.

"BOAC will cooperate with the government and the Saunders-Roe Co. in the operational development of the Princess. It should be possible to acquire the Princess on lease of BOAC's parent Commonwealth and Atlantic routes."

Aquila management made it clear it expected this sudden request of interest with the utmost respect. Relations between the big government-owned corporation and the private operator in Britain are not good. BOAC doesn't like the idea of independent operating services that it might provide at a profit.

■ **Increased Power.**—The Princess was to be powered by four complex Proteus 2 turboprops plus two auxiliary Proteus 2s. The six Princesses were to fly in three engines. But the Proteus 2 was scrapped as uneconomical more than a year ago.

Its successor is the Proteus 3, most advanced version of which is rated at 3,610 shaft horsepower, plus 1,320 ft. thrust. The latter probably could propel the Princess at 560 mph over a 5,000 mi. per range of 5,500 mi.

For immediate action, the proposed production of the later Proteus turboprops will be accelerated for the British Overseas transport. But British announced last week that the engines

would be available eventually for use in the Princess.

The company figures the increased power of the later Proteus will make complete modification on the Princess unnecessary. The assumption is that a Proteus 3-powered Princess would have more than 30 engines, all single installations. Present Proteus has two Proteus engines for each pair of center-outboard pods on the four engine nacelles, one engine for each of the two outboard nacelles.

Specifications on the present Proteus are 270 ft 6 in., length 145 ft, height 55 ft 9 in., gross weight 105,000 lb.

SHORTLINES

■ **Alcock Transport.**—Alcock Transport has more than doubled its scheduled flights passengers carried per month from about 7,000 to more than 15,000, and increased passenger miles from 12 million to 25 million. Alcock has grown in proportion but ACTAN commission for developing the business has been reduced from 10% to 5%.

■ **Business Airlines.**—Alcock has started on a new daily service from Melbourne, Fla., Las Vegas, N. to Death Valley, Calif., but the scheduled service to provide such service.

■ **British European Airways.**—Increased its passenger carried during the first year ending May 31 from 4 million to the year previous to 1,950,000. Revenue carried amounted to \$75,185,480 to \$75,551,680.

■ **Lake Central Airlines.**—has observed its fourth anniversary of continuous scheduled flight operations without a fatal accident, and has been CAA approved to extend its certificate of public convenience and necessity for its annual route until Jan. 1, 1955.

■ **Lines Airports.**—Venezuela, government-owned airline of Venezuela, has begun that nation's first scheduled commercial flights to Europe. Flights depart each Sunday for Lisbon, Portugal and the Azores for London, Portugal.

■ **North Central Airlines.**—has created more than a half-million revenue passengers in its six years of operation, 38.5% of which were carried this year.

■ **Southwest & Western Airlines.**—reports its increased and military operations over the Atlantic and Pacific during September were 5% higher than the same month last year.



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October 18, 1954

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Income Changes Make New Travel Market

Air Transportation Is Expected to Attract Greater Share of Each New Dollar Added to Earnings of Growing Middle-Class Group.

THERE'S BEEN A STRIKING CHANGE—it's been called a revolution—in the facts about the incomes American earn. The revolution has been going on for a good many years, and it has made it easier to understand the world of the potential market for air transportation. Here's what has happened, and it likely to happen in the next few years, to the use and distribution of American income.

1) INCOMES HAVE GROWN SHARPLY since the war. Total personal income after taxes went up by 77.6% between 1939 and the middle of 1951, even after the effects of price inflation have been taken out. Income per person has not grown so fast, because the population has been expanding rapidly (see *American Ways*, Oct. 19, p. 97). But it's up substantially—about 46% since 1939, even allowing for the big increase in the share going to the government as income rises.

Income growth has had a major effect on people's ability to pay for travel, which for many years constituted a luxury. In fact, the effect on ability to indulge in the good things of life (such as air travel) has probably grown even faster than income. The reason is that much of the income added since 1940 has gone to the class of "upper-middle-income"—the highest left over after people have provided for their most basic needs for food, clothing and shelter. In other words, people are busy first in making decisions as to how to spend the income. They use it first for the product or service they find most attractive.

Since the American people are in general well fed, clothed and housed today, more future increases in per capita income will fall into this upper-middle category. That air transportation stands to get a greater share of each added dollar of economy income in the future, provided the service is made sufficiently attractive.

Incomes are not likely to grow as fast in the next few years as they have since 1940. The chief reason is simply that the number of people working and producing goods will be growing at a rate. The number of people in the most active working ages—25 to 64 years—grew 13.9% between 1940 and 1950, but will probably expand by only about 6.7-7.7% between 1950 and 1960. Growth in average income per person will be held back by this slower growth in the labor force. But from the point of view of the air transport industry, the fact that more incomes in income will be over and above the basic living requirements of the population may more than offset the slower rate of total income.

2) THERE HAS BEEN A DRAMATIC CHANGE in the distribution of income among the American people. Income has moved a long way toward equality, and a tremendous middle-class income group has been created in

the process. Back in 1929, people in the middle-income brackets accounted for only 29% of all consumer income. By 1951, they were receiving almost half of all consumer income. (As used here, "middle income" means \$3,000-\$7,400 a year, or 1951 dollars.) And these figures refer to income before taxes. Income taxes have eroded the equal-income picture even further. As an illustration, the top 1% of the population got 18.9% of income after taxes in 1929. By 1949, this group's share was down to 7.2%.

The trend to more equal incomes probably will go on slowly in the future. Some of the influences that caused it—like the highly progressive income tax—have gone about as far as they seem likely to go for a while. Then, too, there's not too much room left for change before incomes actually do become equal. But incomes may continue to move slowly toward equality over the next few years, especially if the nation continues to be prosperous. Prosperity means full employment, in other words. And full employment—big demand for workers—is one of the major causes of the shift in income distribution. When workers are in demand, their wages tend to rise faster than demand, solvent persons and executive salaries—sources of income for the upper-income groups. As incomes move closer together.

What does more equality in incomes mean to the air transport business? It is a major asset for an industry that needs to build a mass market—especially for a truly mass service like air transportation.

With the current income distribution, more income in actual income increases the incomes of a large number of potential air passengers. Under the 1929 distribution, about 19% of any increase in income might have gone to 1% of the population, while the vast majority of people in the lower-income groups would have experienced very little increase in their ability to buy.

However, the income distribution only means that more consumers will become more able to buy air travel as incomes rise. It does not mean that they will buy it.

A large part of American industry is building heavily—with automobiles, new homes, appliances and other good things—into the dollar of the new middle class. Competition for these dollars will get steadily tougher as the next few years pass.

3) INCOMES ARE ALSO MOVING TOWARD equality among the different regions of the country. Back in 1929, per capita income in the Middle Atlantic states was more than 24 times as great as in the South. In the past two decades, the gap between the poorest and richest regions has narrowed by about 60%. Relative improvement in incomes in the less well-to-do regions may turn them into better sources of air travel in the future.

Future articles in this series will discuss the major factors affecting air travel in the changing economy, income trends, changes in business travel, relationship between air travel and personal business activity. Earlier articles in this series Oct. 22 and Oct. 28.

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Critical Times for Cargo Lines

The momentous overseas experiment launched by the Post Office Department to carry ordinary first-class mail by air between New York-Chicago and Chicago-Washington opens up possibilities of a tremendous traffic market for aviation. But in the early stages it appears to offer mixed blessing.

For economic reasons, there is still as great enthusiasm on the part of the participating airlines, and considerable questioning. Misconceiving air carriers want to know what such traffic will do to mail movement in return and expense, how regular service will be affected, whether lines now getting subsidies will get new ones.

Meanwhile, Civil Aeronautics Board holds that the only airlines eligible to carry mail are those whose certificates specifically include mail privileges. All scheduled passenger lines possess mail certification, as well. This appears to keep the unscheduled air freight carriers out of whatever further market develops in mail transportation. Mail is not interpreted as cargo. This strict interpretation of the Board comes at a time when the cargo carriers are fighting to keep their heads above water.

"If the passenger lines are successful in keeping the freight carriers out of this important mail," one air freight observer told *Airways* Week, "the freighter's position is critical, for they can then assure themselves their freight loads which will enable them to make an all-round service that the freight lines will find it difficult to match. The potential in three-cent mail is so great that if the cargo companies cannot participate in this subsidized, government traffic, they are eliminated from the right to bid for one of the biggest—if not the single biggest—pieces of freight business in the country."

CAB says it cannot grant holders of freight certificates any mail rights whatever without first securing the traditional judicial legal procedure pertaining for another certificate. In other words, the cargo carriers probably would be compelled to start from scratch.

Robert W. Prescott, president of the Flying Tiger Line, told a San Diego audience that "the future of civil aviation is in danger of falling into the hands of a staffing monopoly," and called the current situation one of "special privilege that would hurt all future progress to the hands of a few." The founder of the country's first all-freight airline urged aviation to "look forward as well as back" on its golden anniversary.

Prescott, the fighting type, said "historical accident bequeathed grandfather rights to a handful of power groups, thus (1938) struggling in darkness and bankruptcy. Unfortunately, these groups appear to have regarded the Civil Aeronautics Act, and its accompanying law, as a tool to preserve the air transport industry for the good of all the people, but rather as a great bonanza to themselves. They have banded together into one of the strongest Washington lobbies

in existence today for what appears to be two opposite purposes: (1) protect and increase their own subsidies, (2) keep out, by the use of the law of the people, any possible competition from any newcomer to the field of aviation."

Prescott repeated the frequent comment of the new scheduled carriers, that "not one single passenger trunk line has been certificated in comparison to these 'grandfather' lines in the 15 years that have passed since passage of the Civil Aeronautics Act."

Prescott said "and it not here for the overwhelming proof that we offered the CAB, at a cost of hundreds of thousands of dollars in learning expense and law fees, that air freight service was needed in this country... we would not have passed even the temporary certificate we now hold."

These certificates, Prescott pointed out, "contain specific provisions denying an airline, the right to carry U. S. mail, or an express or, in effect, do anything that offers any possible competition to the subsidized passenger airlines."

The air freight carriers last year moved 240 million lb. of freight, Prescott said, "of which nearly one-half was transported by the nation's four freight carriers in competition with 18 scheduled lines." This year the industry would develop nearly \$60 million worth of traffic. "Yet the slow strangling by our passenger competitors may yet sound a death knell for us, because of a government decision that thus far permits only passenger lines to carry on the current experiment in moving first-class mail by air."

Prescott said the freight lines proposed this idea in 1947 and made the claim that it probably could save the government \$40 to \$50 million a year by reducing the cost of airmail.

"Recently, the Post Office, eager to get rid of high-cost mail pay at 45 cents a ton-mile, unannounced it was going to try an experimental and hard three-cent mail by air. The rate offered by the Post Office was 34 1/2 cents a ton-mile. We were the only ones in line waiting to take it."

"The grandfather lines announced that they would fight it if the government would make up by subsidy any loss of revenue of the 45-cent per ton-mile traffic. How ever, the Post Office declined. The CAB offered its blessing to the experiment and the project was begun. But here is the hitch. Only the grandfather lines who have steadily fought the project since 1947, when we first proposed it, and who stand to lose the most if the experiment is successful, were given the right to fly it."

The cargo carriers, born in labor and strife, now face the prospect of denying whether to fight for the renewal of their certificates—were to expire—in the face of heavy obstacles, as to run up the white flag. The best and most economical public service is the only issue. With regular officials have some heavy thinking ahead of them before they dare to let these unscheduled operators go out of business.

—Robert W. Wood

BLIND FLYING...

another Sperry first... 1929

"Blind" flying has an interesting history. For years many people had flown "blind" on occasion through clouds. And in 1926, William C. Ocker proved man's physiological capability to fly "blind" without instruments. His experiments, based on the Sperry developed Tura and Bank indicators helped pilots understand and use flight instruments. The use of dependable all-weather flying did not begin, however, until Lieutenant "Jimmy" Doolittle made his historic "blind" flight in 1931. With the aid of two new Sperry instruments—an artificial horizon and a gyroscopic directional indicator—helped the way to dependable all-weather flying.

TODAY, AS THEN, SPERRY LEADS THE WAY

Twenty-five years have passed since the Doolittle flight. In those years Sperry has pioneered in development since development, utilizing techniques to make better instruments more precise, and to provide still greater mastery of the elements. With the Sperry Zero Reader® Flight Director, for example, military pilots now routinely fly and navigate at supersonic speeds with accuracy and precision approaching that of automatic flight—and, with Sperry instrument can intercept and destroy enemy aircraft unseen by human eyes.

See us today at

1932 Captain A. P. Replogle in Douglas BT-2A makes first "blind" flight and landing at Wright Field, with Sperry Gyro Horizon and Directional Gyro.

1941-45 Sperry flight instruments, built by U. S. Navy and Marine Corps to operate from carriers, duty of high-altitude fighters help pilots locate enemy aircraft and submarines.

1936 Air Corps Major Ira Eaker, left, makes first transcontinental "blind" flight and then in BT-2A, equipped with Sperry Gyro Horizon and Directional Gyro. Major William E. Kepner pilots second plane.



1929 In covered cockpit of his NV-2, Lieutenant "Jimmy" Doolittle, with Gyro Horizon and Directional Gyro makes first "blind" flight including takeoff and landing. Lieutenant Ken Bellamy acts as check pilot.



1953 The Sperry Zero Reader Flight Director is conspicuous with color scale advantages at high altitudes, day or night.

SPERRY GYROSCOPE COMPANY
A Division of the General Electric Company
Small scale view here

One of a series of illustrations commemorating the flight anniversary of Paved Flight

Wobble means wear

Formula
for Failure

$$\frac{w + e + s + \alpha}{\times v} =$$

a loose
connection



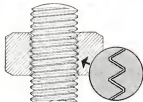
Elastic Stop nuts can't wobble

Formula for Failure—[(w) Initial thread wear + (e) bolt stretch + (s) thermal expansion or contraction + (α) wobble] × (v) vibration = a loose connection.

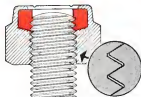
WOBBLE, permitted by normal axial thread play, and vibration are two of the major elements contributing to thread wear, loose connections and ultimate failure of a threaded fastener.

One device—the elastic locking insert—eliminates axial play and dampens destructive, wear-producing vibration. Because of the locking action of ESNA's famous red elastic collar, *ELASTIC STOP* nuts *do not loosen under vibration*.

Other important ESNA advantages include quick application and precise adjustment, reuseability, protection against liquid seepage, and uniform bolt loading. Mail our coupon for design information.



YOU CAN WOBBLE AN ORDINARY NUT AND BOLT with your fingers. This is the result of the tolerance spread permitted by the several closes of thread fit.



GRIPPING THE BOLT WITH A PERFECT FIT, ESNA's red elastic collar enforces a constant downward pressure that eliminates axial play, enforcing a positive contact between load-carrying sides of bolt and nut threads.



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